



# InterPACK 2022

International Technical Conference and Exhibition on Packaging  
and Integration of Electronic and Photonic Microsystems

# Program

CONFERENCE  
October 25–27, 2022

Hyatt Regency Orange County,  
Garden Grove, CA

<https://event.asme.org/InterPACK>



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# Dear InterPACK Participants,

Dear InterPACK Participants,

On behalf of the ASME Electronic and Photonic Packaging Division (EPPD), welcome to the 2022 International Technical Conference and Exhibition on Packaging and Integration of Electronic and Photonic Microsystems (InterPACK) being held at the Hyatt Regency Orange County in Garden Grove, California, on October 25–27, 2022.

The InterPACK Conference is a premier event organized by the ASME EPPD and holds a rich history of serving as a platform for exchanging information on cutting-edge research in the areas of electronic and photonic packaging, thermal management, and reliability of electronic devices, components, and systems to numerous researchers and technical professionals from Academia, Government, and Industry. After three years of the pandemic, the 2022 InterPACK conference will be held in-person. The organizers have developed a comprehensive technical program comprising comprised of nearly 150 technical papers and presentations, including approximately 90 original full technical publications, as well as tutorials, panels, workshops, and keynotes and plenary talks aligned with the areas of heterogeneously integrated systems; data centers, servers of the future, edge and cloud computing; flexible, wearable, and additively printed electronics; photonics and optics; power electronics; multiscale thermal transport, thermal materials, and energy systems; harsh environment electronic applications for transportation systems; reliability of electronic packages and systems; and digital technologies in microelectronics. Like the previous InterPACK conferences, the program is organized to promote networking between government, academia, and industry researchers and professionals in the relevant field offering opportunities to foster collaborations. Students will have an opportunity to present their work during interactive presentation sessions and discuss with senior researchers and industry leaders their future career path during a career fair.

We are pleased to announce that there will be six plenary talks from distinguished professionals in the area of electronic and photonic packaging, including Thomas E. Kazior (DARPA; Heterogenous Integration, an Enabler for Next Generation Systems), Ivor Barber (AMD; Integrations Strategies in Chiplet Era), Mark S. Spector (ONR; Thermal Challenges for Future Military Platforms), Philseok Kim (ARPA-E; Pushing the Boundaries of Thermal Packaging for Enhanced Performance and Energy Efficiency), and Abhinav Saxena (GE; The Uuse of AI and ML in Improving Industrial Reliability Ttowards Achieving Operational Autonomy, Successes and Challenges). In addition, we will have seven track-level invited keynotes. It is remarkable that emerging areas in electronics and photonics have recently demonstrated significant



development, and we will continue to highly encourage research and development in such emerging areas and technologies that align with the direction and goals of the ASME EPPD through the conference. Accordingly, this year, we have added a new track titled, Digital Technologies in Microelectronics, and this track has attracted prominent levels of interest from researchers both from academia and industry. Furthermore, we are pleased to have a panel on Why AI/Data Science Projects Fail, and tutorials in the emerging areas of nano-photonic systems, advanced liquid cooling, and optimization battery recycling for sustainability. Finally, we will hold a workshop dedicated to the recently announced ChipsHIPS and Science Act (CHIPS) and learn how the U.S. domestic semiconductor manufacturing, design and research can be strengthened in the near future.

We hope that you will enjoy the program that has been organized by numerous volunteers contributing as track chairs, session chairs, workshop and tutorial organizers, panel moderators, and technical paper reviewers. We are indebted to our volunteers as well as to the ASME Staff for their vigorous efforts to make this conference a premier event. We also thank all our sponsors across the globe for their generous sponsorship funds as well as participation in the technical sessions.

Thank you and we all look forward to meeting you at InterPACK 2022!

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*Meta*

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**Prof. Pradeep Lall**

*Auburn University*



## REGISTRATION INFORMATION

Registration will be located at the **Royal Foyer** on the First Floor of the hotel. The hours are as follows:

Monday, October 24  
3:00PM–6:00PM

Tuesday, October 25  
7:00AM–5:00PM

Wednesday, October 26  
7:00AM–5:00PM

Thursday, October 27  
7:00AM–4:00PM

## AUDIOVISUAL EQUIPMENT IN SESSION ROOMS

All technical sessions rooms are equipped with an LCD projector and screen. Laptops will NOT be provided in the sessions. Session chairs typically provide their laptops for all the author presentations, or you may bring your own. Please bring your presentations on a jump drive 10–15 minutes before your presentation to upload it on the laptop provided by the session chair.

## BADGE REQUIRED FOR ADMISSION

All conference attendees must always wear the official ASME 2022 InterPACK badge in order to gain admission to technical sessions, exhibits, poster sessions, meals, and other conference events. Without a badge, you will NOT be allowed to attend any conference activities. Your badge also provides a helpful introduction to other attendees.

## CONFERENCE AWARDS LUNCHEONS

### 2022 AVRAM BAR COHEN AWARD LUNCHEON

**Tuesday, October 25**  
11:45PM–1:15PM  
Royal C & D, First Floor

### InterPACK ALAN KRAUS AWARD LUNCHEON

**Wednesday, October 26**  
11:45PM–1:15PM  
Royal C & D, First Floor

### InterPACK EPPD, JEP, AND NASSER GRAYELI POSTER AWARDS LUNCHEON

**Thursday, October 27**  
11:45PM–1:15PM  
Royal C & D, First Floor

## CONFERENCE NETWORKING BREAKS

Morning and afternoon breaks will be provided in the Royal Foyer located on the First Floor. Join your fellow attendees for a few minutes of networking and discussion. The schedule is as follows:

**Tuesday, October 25–Wednesday, October 26**  
10:00AM–10:15AM  
3:45PM–4:00PM

**Thursday, October 27**  
10:00AM–10:15AM

# General Information

## CONFERENCE PROCEEDINGS

Each attendee will be provided with an individual link to the online papers via email. In the event you do not receive the email, send a request to [conferencepubs@asme.org](mailto:conferencepubs@asme.org). Access to all the papers accepted for presentation at the conference will be found online with this link. The official conference archival proceedings will be published after the conference and will not include accepted papers that were not presented at the conference. The official conference proceedings are registered with the Library of Congress and are submitted for abstracting and indexing. The proceedings are published on the ASME Digital Library.

## REGISTRANTS WITH DISABILITIES

Whenever possible, we are pleased to plan for registrants with disabilities. Advance notice may be required for certain requests. For on-site assistance, please visit the conference registration area and ask to speak with a conference representative.

## ABOUT GARDEN GROVE, CALIFORNIA

Garden Grove was founded by Alonzo Cook in 1874. A school district and Methodist church were organized that year. It remained a small rural crossroads and farming community until the arrival of the Pacific Electric Railroad in 1905. The rail connection helped the town prosper with the influx of tourists, visitors, and eventually settlers, and it was noted for its crops of oranges, walnuts, chili peppers, and later strawberries.

In 1933, much of the town's central business district was destroyed by the Long Beach earthquake, and one person was killed at the high school. The post-World War II boom led to rapid development, and Garden Grove was incorporated as a city in 1956 with about 44,000 residents.

In 1956, Orange County Plaza (now The Promenade) was opened at Chapman and Brookhurst, and upon its expansion in 1959, it had 60 stores, including a J. C. Penney, two variety stores, and two supermarkets, and billed itself as both the largest and the first regional shopping center in Orange County

### Strawberry Festival

An annual event held over Memorial Day weekend, the Garden Grove Strawberry Festival is one of the largest community festivals in the western United States, attracting an estimated 250,000 visitors. It began in 1958 and celebrates the city's agricultural past, which includes cultivating crops such as chili peppers, oranges, walnuts, and strawberries. Part of the festivities include the cutting of the world's largest strawberry shortcake, carnival rides, food vendors, live music, and a celebrity-filled parade. Numerous Garden Grove organizations, including the Miss Garden Grove Scholarship Program, are part of the Memorial Day weekend festivities every year. In commemoration of Garden Grove's 50th anniversary, the city painted some of its fire hydrants with a design that featured a strawberry, recognizing the festival as a big part of Garden Grove's history.

## HOTEL

The fun never stops at Hyatt Regency Orange County, with amenities, entertainment, and attractions to enjoy. As a *Disneyland*® Good Neighbor hotel, they offer park shuttle services that depart from the hotel lobby entrance, just minutes from the park's entrance

### Hyatt Regency Orange County

11999 Harbor Blvd  
Garden Grove, California, USA 92840  
Tel: +1 714 750 1234 | Fax: +1 714 740 0465

## QUESTIONS ABOUT THE MEETING

If you have any questions or need assistance, an ASME representative will be located at the conference registration area.

# Program at a Glance

Pacific Time		Type	Speakers/Tech Sessions	Presentation Title	Company	Room/ Tech Sessions
Day 1 - Monday, October 24						
7:00 PM	9:30 PM		InterPACK Leadership Dinner - By Invitation Only			
3:00 PM	6:00 PM		Registration Opens			Royal Foyer, First Floor
Day 2 - Tuesday, October 25						
7:30 AM	8:30 AM	Plenary 1	Thomas Kazior	Heterogeneous Integration (HI): An Enabler for Next Generation Systems	DARPA	Royal A & B, First Floor
			Regal Room, First Floor	Valencia Room, Second Floor	Madrid Room, Second Floor	Granada Room, Second Floor
8:30 AM	10:00 AM	Tech Sessions	01-01	02.01	03.01	08-03
8:30 AM	10:00 AM	Panel 1	Women in Engineering			Terrace, D-F, First Floor
8:30 AM	10:00 AM	Tutorial 4	Recipe for Heterogenous Integration Packaging Roadmapping			Seville Room, Second Floor
10:00 AM	10:15 AM	Break	Coffee Break/Exhibitor Corner			Royal Foyer, First Floor
10:15 AM	11:45 AM	Workshop 1	Roadmapping Advanced Packaging for Electronics Manufacturing, with INEMI			Royal A & B, First Floor
			Valencia Room, Second Floor	Madrid Room, Second Floor	Granada Room, Second Floor	
10:15 AM	11:45 AM	Tech Sessions	02-02	06-01	08-04	
11:45 AM	1:15 PM	Lunch	Avram Bar-Cohen Award Luncheon			Royal C & D, First Floor
1:15 PM	2:15 PM	Plenary 2	Ivor Barber	Integration Strategies in the Chiplet Era	ARPA-E	Royal A & B, First Floor
2:15 PM	3:45 PM	Workshop 2	Microelectronic and Advanced Packaging Technologies Roadmap			Royal A & B, First Floor
2:15 PM	2:45 PM	Track Keynote	Track 5 Form and Function in Power Electronics: Driving Progress in Efficient Energy Conversion by Matched Technology-Topology Integrated Design - Alberto Castellazzi			Regal Room, First Floor
			Regal Room, First Floor	Valencia Room, Second Floor	Madrid Room, Second Floor	Granada Room, Second Floor
2:15 PM	3:45 PM	Tech Sessions	05-02	02.03	07-01	08-05
3:45 PM	4:00 PM	Break	Coffee Break / Exhibitor Corner			Royal Foyer, First Floor

# Program at a Glance

Pacific Time		Type	Speakers/Tech Sessions	Presentation Title	Company	Room/ Tech Sessions
4:00 PM	5:30 PM	Panel 8	Heterogeneous Integration Roadmapping			Royal E & F, First Floor
			Regal Room, First Floor	Valencia Room, Second Floor	Madrid Room, Second Floor	
4:00 PM	5:30 PM	Tech Sessions	05-02	02.04	06.03	
4:00 PM	5:30 PM	Sponsors	Sponsor Presentations - Raytheon, Jim Wilson, META, Saket Karajgikar, NREL, Sreekant Narumanchi, Intel, Ravi Mahajan			Royal E & F, First Floor
5:30 PM	7:00 PM	Posters	10-01 - Interactive Presentations Session (Posters)			Royal E & F, First Floor
InterPACK Organization Meetings						
7:00 PM	8:00 PM	K-16 Committee Meeting	Seville Room, Second Floor			
8:00 PM	9:00 PM	EPPD Meeting	Valencia, Second Floor			
Day 3 - Wednesday, October 26						
7:30 AM	8:30 AM	Plenary 3	Mark Spector	Thermal Challenges for Future Military Platforms	Office of Naval Research	Royal A & B, First Floor
8:30 AM	10:00 AM	Panel 3	Hybrid and System Level Integration for Electronics Packaging			Imperial Room, First Floor
8:30 AM	10:00 AM	Track Keynotes	Track 2: Managing Data Center Challenges in the Age of AI Track 4: High Brightness Illumination Based on Laser Light Diffusion With Mie Scattering Track 8: Past and Future of Reliability Assessment of Electronic Materials			Regal Room, First Floor
8:30 AM	10:00 AM	Tutorial 2	Advanced Liquid-cooling Technology for ICT: Performance and Economic Benefit			Seville Room, Second Floor
10:00 AM	10:15 AM	Break	Coffee Break/Exhibitor Corner			Royal Foyer, First Floor
10:15 AM	11:45 AM	Panel 4	Pathfinding to Maximize System Performance			Imperial Room, First Floor
			Regal Room, First Floor	Valencia Room, Second Floor	Madrid Room, Second Floor	Granada Room, Second Floor
10:15 AM	11:45 AM	Tech Sessions	05-03	02-05	06-04	08-01
10:15 AM	11:45 AM	Tutorial 1	Nanophotonic Systems: Novel Nanophotonics Device and Future Applications in Electronics			Seville Room, Second Floor
11:45 AM	1:15 PM	Lunch	Allan Kraus and Intel Awards Luncheon			Royal C & D, First Floor
1:15 PM	2:15 PM	Plenary 4	Philseok Kim	Pushing the Boundaries of Thermal Packaging for Enhanced Performance and Energy Efficiency	ARPA-E	Royal A & B, First Floor



# Program at a Glance

Pacific Time		Type	Speakers/Tech Sessions	Presentation Title	Company	Room/ Tech Sessions
2:15 PM	3:45 PM	Panel 5	Thermal and Mechanical Challenges and Opportunities of Advanced Mobile/Telecom/IoT/Auto/Computing Devices			Imperial Room, First Floor
			Regal Room, First Floor	Valencia Room, Second Floor	Madrid Room, Second Floor	Granada Room, Second Floor
2:15 PM	3:45 PM	Tech Sessions	01-02	04-01	03-02	08-02
2:15 PM	3:45 PM	Workshop 3	Introduction to Robotics, AI, and Intel's OpenVINO Toolkit			Terrace D-F, First Floor
3:45 PM	4:00 PM	Break	Coffee Break/Exhibitor Corner			Royal Foyer, First Floor
4:00 PM	5:30 PM	Panel 6	Sustainable Energy Systems in ICT			Terrace, D-F, First Floor
			Regal Room, First Floor	Valencia Room, Second Floor	Madrid Room, Second Floor	Granada Room, Second Floor
4:00 PM	5:30 PM	Tech Sessions	03-03	02-06	06-05	08-06
4:00 PM	5:30 PM	Workshop 4	K16 Professional Development & Mentoring			Seville Room, Second Floor
InterPACK Organization Meetings						
5:30 PM	7:00 PM	InterPACK Meeting (Open)				Madrid Room, Second Floor
8:00 PM	8:30 PM	InterPACK Advisory Meeting				Seville, Second Floor
8:30 PM	9:00 PM	Journal of Electronic Packaging (JEP) Meeting				Valencia, Second Floor
Day 4 - Thursday, October 27						
7:30 AM	8:30 AM	Plenary 5	Abhinav Saxena	Use of AI and ML in Improving Industrial Reliability towards Achieving Operational Autonomy – Successes and Challenges	GE Research	Royal A & B, First Floor
8:30 AM	10:00 AM	Track Keynotes	Track 1: Wining Road to Maximize System Performance Track 3: Anisotropic Conductive Epoxy for High-Volume Manufacturing of Flexible - Stretchable Wearable Electronics Track 9: Building Explainable AI for the Enterprise			Regal Room, First Floor
8:30 AM	10:00 AM	Panel 7	Reliability of Additively Manufactured Electronics			Imperial Room, First Floor
8:30 AM	10:00 AM	Tutorial 3	Optimization of Battery Recycling for Sustainability			Seville Room, Second Floor

# Program at a Glance

Pacific Time		Type	Speakers/Tech Sessions	Presentation Title	Company	Room/ Tech Sessions
10:00 AM	10:15 AM	Break	Coffee Break/Exhibitor Corner			Royal Foyer, First Floor
10:15 AM	11:45 AM	Panel 2	Impact of Sustainability Goals on Future Hardware and Data Center			Imperial Room, First Floor
10:15 AM	11:45 AM	Panel 9	Why AI/Data Science Projects Fail			Seville Room, Second Floor
			Valencia Room, Second Floor	Madrid Room, Second Floor	Granada Room, Second Floor	
10:15 AM	11:45 AM	Tech Sessions	05-04	06-06	03-04	
11:45 AM	1:15 AM	Lunch	Nasser Grayeli Poster, Electronic Photonic Packaging Division (EPPD), Intel, Best Poster, and Journal Electronic Packaging (JEP) Awards			Royal C & D, First Floor
1:15 PM	2:15 PM	Plenary 6	John Williams	Multilayer Flexible Electronic Devices for IoT and RF Applications	Boeing	Royal A & B, First Floor
			Regal, First Floor	Valencia Room, Second Floor	Madrid Room, Second Floor	Granada Room, Second Floor
2:15 PM	3:45 PM	Tech Sessions	09-01	02-07	03-05	08-07
4:00 PM	Conference Ends					



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Contact:

**Ravi Mahajan**

[ravi.v.mahajan@intel.com](mailto:ravi.v.mahajan@intel.com)

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National Renewable Energy Laboratory (NREL) researchers within the Advanced Power Electronics & Electric Machines (APEEM) Group have expertise in thermal, electrothermal, mechanical, and reliability of power electronics and electric machines for energy efficiency and renewable energy applications, such as electric-drive vehicles. In collaboration with research and industry partners, NREL's APEEM Group is developing novel thermal management technologies to improve the performance, cost, reliability, and volume of power electronics and electric machines. NREL has five facilities dedicated to APEEM research, featuring a range of equipment to investigate primary research areas of 1) electronic and power electronic devices and sensors, 2) power electronics thermal management, 3) power electronics packaging reliability and prognostics, 4) electric motor thermal management, 5) integrated electric drive thermal management.

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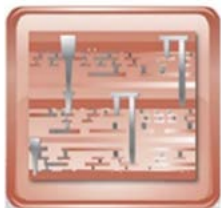
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## SILVER SPONSOR



The *Journal of Electronic Packaging* publishes papers that use experimental and theoretical (analytical and computer-aided) methods, approaches, and techniques to address and solve various mechanical, materials, and reliability problems encountered in the analysis, design, manufacturing, testing, and operation of electronic and photonics components, devices, and systems.

The journal publishes papers that address 1) thermal management, applied mechanics and technologies for microsystems packaging; 2) critical issues in systems integration; 3) emerging packaging technologies and materials with micro/nano structures; and 4) general small-scale systems.

The journal serves researchers and engineers working in academic and industrial settings. In addition, leaders in the field are invited to publish review articles on hot, emerging, and fundamental topics.

**Scope:** Electronic packaging; Thermal management; Applied mechanics; Microsystems packaging; Systems integration; Small scale systems in general.

**Contact:**

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For more information, please visit our website: <https://www.novarktechnologies.com/>

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The A. James Clark School of Engineering is one of the premier engineering schools in the United States, ranked #1 among the country's public universities in U.S. News & World Report 2022-23 Best Colleges rankings and the largest producer of STEM Talent in the nation's capital region. We are home to over 6,000 students and 250 faculty and staff working to advance technology, innovate in education and translate impactful solutions for the public good. This includes new advanced technologies that help farmers tap the economic potential and environmental benefits of shellfish aquaculture, technologies to transform wood into forms that are clear, bulletproof, and insulating that may help in numerous applications, and biomedical technologies that are helping to shape the future of healthcare for all. These and other research innovations poised to benefit millions around the globe.

With industry-leading expertise in areas that are shaping society such as quantum technology, autonomy, bioengineering, energy, robotics, communications and networking, life cycle and reliability engineering, disaster resilience, and intelligent transportation systems, the Clark School conducts research relied upon by federal agencies, major companies, and other academic institutions alike. Award-winning student-led competition teams are the norm, while startup companies from our Startup Shell are bringing ideas from our students directly to the marketplace. With our regional and local partners, we have also made contributions to major activities in space such as the DART mission, developed the most advanced transportation research and analytics group in the country, and completed the first autonomous delivery of an organ for transplant via drone to a patient in Baltimore. Taking on the challenge of bringing big ideas to life is what we do each day.

Our guiding mission is to become the place where students and faculty come to make a positive impact on the world. We believe in practicing engineering as public service: innovating for people in communities we may never see or meet but whose quality of life will be improved through our work.

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The University of Texas at Arlington is a Carnegie Research Institution (High Research Activity) and Tier One University whose mission is the advancement of knowledge and the pursuit of excellence in research, teaching, and service to the community. The mission statement affirms UT Arlington's commitment to expanding academic research; attracting and retaining high-quality faculty scholars who actively engage students; providing a well-rounded academic experience that promotes student involvement, service learning, and free discourse; to employing alternative access venues to meet student's needs; and to develop public and private partnerships.

### **College of Engineering.**

The University of Texas at Arlington's College of Engineering has emerged as one of the most comprehensive engineering programs in North Texas and the nation. It offers 11 baccalaureates, 14 master's, and nine doctoral degree programs, and programs are ranked by U.S. News and World Report as among the best in the nation. With more than 7,500 students and more than 34,000 alumni, the College of Engineering is the fourth largest in Texas, providing the local, regional, and national workforce with motivated and highly skilled graduates.

Electronics, MEMS, and Nanoelectronics Systems Packaging Center (EMNSPC) is a first-class research center that meets the needs of industry, and in particular, the state of Texas and the North Texas region's "Electronic, MEMS and Nanoelectronics Packaging Industry". This includes research, education, and training. The latest push in thermos/mechanical challenges in heterogeneous integration. Professor Agonafer has been given resources

including a 3000 sq ft lab space complete with the renovation and new equipment, 2 faculty lines, .. to start a new center called RAHIS (Reliability Assessment in Heterogenous Integrated Systems). The new equipment includes Hysitron TI 980 Nanoindenter, SONIX Scanning Acoustics Microscope, S.E.C. Model 865 Flip Chip Bonder with Dual Camera Vision, Thermal Shock Chamber, HALT Chamber, TMA 7100, and DMA 7100 among other.

UTA is a partner in the NSF I/UCRC Center for Energy-Smart Electronic Systems, working with the government, industry, and academia to develop systematic methodologies for efficiently operating electronic systems. Our lab focuses on developing advanced technology for the cooling of components at both hardware level and chip level from the aspects of both thermal and reliability. The new lab space includes a state-of-the-art immersion cooling lab (with five industrial partners) that include Particle Image Velocimetry (PIV), Airflow Bench, Thermal chamber, and many more.

More information at: <https://blog.uta.edu/emnspc/>

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URL: <https://www.staubli.com/us/en/fluid-connectors/industries/it-telecom-broadcasting.html>

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# Track Keynotes

## TRACK 1 – WINING ROAD TO MAXIMIZE SYSTEM PERFORMANCE

THURSDAY, OCTOBER 27

8:30AM–10:00AM

REGENCY A

### Moderators:

Amanie Abdelmessih, *California Baptist University*

Timothy Chainer, *IBM*

### Keynote Speaker:

**Gamal Refai-Ahmed, Ph.D., LFASME, FIEEE, FCAE, FEIC, Sr. Fellow AMD**

**Abstract:** As technology nodes shrink and power density increases, thermal issues become more challenging and need to be addressed with innovative solutions. In this presentation, we highlight the path finding to maximize the system performance. In this talk a roadmap and a pathfinding are presented. Furthermore, the presentation is disclosing key factors that need to be considered in developing the present and next generation of thermo-mechanical solutions. These factors are enabling and working on/ around manufacture infrastructure, accommodating future heterogeneous integration, utilizing current/future infrastructure of board level manufactured assembly, addressing the solution from system level, extending air cooling, enabling liquid cooling, and considering immersion liquid cooling. Based on these factors, a pathfinding strategy will be built on four elements/pillars, which are hosting facilities, driving ecosystems, defining cost based on operating condition and reliability, and synergistic management of workload in both IT equipment and cooling systems.



**Gamal Refai-Ahmed,**  
*Ph.D., LFASME, FIEEE, FCAE, FEIC, Sr. Fellow AMD*

Dr. Gamal Refai-Ahmed, Life Fellow ASME, Fellow IEEE, Fellow Canadian Academy of Engineering, Professional Engineer Ontario, is AMD Senior Fellow. He obtained the Ph.D. degree from the University of Waterloo. He has been recognized as one of the global technical leaders through his numerous publications (more than 120 publications) and patents and patents pending U.S. (more than 65) and international (more than 110). His contributions are clearly seen in several generations of both GPU, CPU, and FPGA for HPC, AI, ML, NIC, Game Console, Aerospace & Defense, and Telecom products.

In 2015, Gamal was tasked to initiate the heterogeneous integration of system level power, thermal, mech, and assembly with package and Si development in the first initial planning. He has been a key player to introduce all Alveo products and high-end Si CoWos, InFo, Chiplets PKG to AMD customers. He was behind the introduction of the first Lidless FPGA 20, 16, 7nm technology nodes with highest warpage in mass production in Alveo products, and its Telecom, AI, HPC customers (e.g., MSFT, AWS,

Nokia, Cisco, and A&D). His developed strategy of technology enables AMD FPGA products to outperform the Intel/Altera Products.

Gamal is the recipient of the 2008 excellent thermal management award, 2010 Calvin Lecture, and 2013 K16-Clock award in recognition for his scientific contributions and leadership of promoting best electronics packaging engineering practice. In 2014, Gamal received the IEEE Canada R. H. Tanner Industry Leadership for sustained leadership in product development and industrial innovation. In 2016, ASME awarded Gamal the ASME Service Award. State University of New York, Binghamton University awarded him the Innovation Partner Award for his industrial role with Binghamton University. In continuation to Dr. Refai contributions to the best engineering practice, the State University of New York at Binghamton awarded him the Presidential University medal in 2019, which is the highest recognition honor by the university. In 2021, Gamal was elected to IEEE Fellow and EIC Fellow.

## TRACK 2 – MANAGING DATA CENTER CHALLENGES IN THE AGE OF AI

WEDNESDAY, OCTOBER 26

8:30AM–10:00AM

REGAL ROOM, FIRST FLOOR

### Organizer:

Ali Heydari, *Distinguished Data Center Technologist, Nvidia*

### Moderator:

Gamal Rafai-Ahmad, *AMD*

### Keynote Speaker:

Ali Heydari, *Distinguished Data Center Technologist, Nvidia*

**Abstract:** Artificial intelligence and machine learning applications are about to permanently change the design of data centers where liquid will be coming closer than ever as the common medium to cool the core of computational servers from GPU, CPU, Switch, and other components. Hybrid air and liquid cooling with direct to chip cooling design is going to be the low hanging fruit of choice for designers where liquid will be used to directly cool high heat density components while air will continue to cool other components. Design of liquid plumbing, selection of cooling distribution units, selection of compatible wetted materials list, and reliability/serviceability issues are some of the challenges that industry is striving to resolve as we see more data centers preparing to embrace liquid for cooling servers and other IT equipment. Utilizing CFD, FNM, and Omniverse tools to create digital twins of high heat density data centers to address many challenges of high heat density data centers in the age of AI is presented.



**Ali Heydari**,  
Distinguished Data Center Technologist, Nvidia

Ali Heydari is a Distinguished engineer and Data Center Technologist at Nvidia in charge of all data center cooling technology development at Nvidia. In this role, he is developing direct to chip liquid cooling technologies using cold plates, cooling distribution units and manifolds for cooling of Nvidia's high heat density data centers. Prior to Nvidia, he worked as senior director in charge of Rigetti's Quantum Computers using the most futuristic technology in today's data center compute.

Accomplishments include, setting up the first Quantum Cloud Services enabling over the cloud access of the Quantum Computers. Prior to that he served as Senior Technical Director and Chief Data Center Architect at Baidu, the largest search engine and AI company in China. In this role, he was server and data center architect in charge of hardware and data center design, development, and deployment in China's largest data center search and AI company.

Formerly, he was Senior Hardware Engineer at Twitter where he was responsible for ground up development of Twitter's data center ODM server development. Earlier, he was Senior Hardware Engineer at Facebook where he helped in developing Facebook's original OCP server and data center products. Prior to that he worked at Sun Microsystems and spend about 10 years as Associate Professor of Mechanical Engineering at Sharif University of Technology in Iran. He received his B.S. in mechanical engineering from University of Illinois, Urbana, M.S., Ph.D. in mechanical engineering, and M.A. in applied mathematics from University of California, Berkeley. He has over 25 issued patents in data center cooling technologies.

## TRACK 3 – NOVEL ZTACH® ACE: ANISOTROPIC CONDUCTIVE EPOXY FOR HIGH-VOLUME MANUFACTURING OF FLEXIBLE - STRETCHABLE WEARABLE ELECTRONICS

THURSDAY, OCTOBER 27

8:30AM–10:00AM

REGAL ROOM, FIRST FLOOR

**Organizer:**

**Benjamin Leever**

**Moderator:**

**Benjamin Leever**

**Keynote Speaker:**

**John Yundt**, *SunRay Scientific*

**Abstract:** Advancements in the development of Flexible Hybrid Electronics (FHE) materials and technologies continues to progress rapidly; nonetheless, high-volume manufacturing of complex FHE-based products with high reliability remains elusive. This issue becomes even more noteworthy, especially in regard to printable wearable applications and technologies. Beyond flexible electronic devices that are inherently bendable, stretchable electronic devices are the next evolutionary developmental need for a wide array of real-world applications. Due to the nature of the biaxial strain induced during use, such stretchable devices are expected to be mechanically robust while maintaining electrical performance even under dynamic high tensile strains. Most of these stretchable electronic devices are hybrid in nature, being comprised of both soft and rigid electronic components. Hence, robust and reliable electrical interconnections between such soft and rigid components are necessary to ensure proper functionality of the device. Currently, interconnections between functional electrical systems and the wearable e-textile materials utilize traditional methods such as high-pressure Anisotropic Conductive Adhesives or Films (ACA/ACF), rigid solder connections, snap/cinch connections, and isotropic conductive adhesives (ICA). Each of these interconnection methods poses a variety of issues with the necessary material sets for wearables/e-textile materials. There are significant drawbacks related to mechanical and/or thermal damage during the connection process; poor mechanical adhesion; inability to connect standard-pitch functional devices; and lack of robustness when connecting to nonplanar surfaces seen in wearable device configurations.

Additional challenges with these interconnect methods limit high-volume manufacturing of such products. SunRay Scientific Inc. will present recent results in the development of a novel anisotropic conductive adhesive, ZTACH® ACE, for high-volume surface mount assembly of electrical components, including those elements mounted/attached to flexible, stretchable membranes and textiles in wearable applications.

Prior research and development have demonstrated the technology behind ZTACH® ACE with superior performance in achieving environmentally stable and mechanically robust electrical connections. For improved manufacturability, this interconnect method allows for pressure-less assembly, low-temperature cure, excellent adhesion to a variety of substrates, and fine pitch reliability without sacrificing contact resistance or mechanical bond integrity. The ability of ZTACH® ACE to concurrently serve as its own underfill and edge encapsulant improves reliability especially with respect to the rigors of use in typical wearable applications on host substrates like textiles and TPU. It has been shown that ZTACH® ACE interconnects do not experience the same types of failures conventional competing technologies experience without the addition of underfill and/or encapsulation. In providing superior adhesion, low contact resistance, and mechanical robustness during electromechanical testing, ZTACH® ACE proves itself to be a reliable interconnect solution between stretchable to stretchable/flex/rigid materials with high electrical conductivity. With demonstrated scalability, these attributes enable easier and lower cost manufacturing of more flexible and robust applications through integration of SMD components directly onto e-textiles, without needing additional laminated protective layers. As a result, flexible wearable printed electronics can readily be incorporated into a wider range of cost-effective, reliable end use applications.

Beyond Flexible – Stretchable Electronic applications, ZTACH® ACE is suitable for semiconductor interconnect needs given high-yield finer pitch attributes. Successful developments have been achieved with demonstrations of IR FPAs, large-format area arrays, and RF applications. Continuing materials and processing maturation of this technology is expected to substantially address reliability and longevity requirements along with appreciable low-cost advantages most needed for semiconductor packaging and assembly.



**John Yundt,**  
*SunRay Scientific*

**L** John M. Yundt is a graduate of Western Illinois University, with 28 years of experience in printed electronic materials and conductive coatings. Beginning his career at Acheson Industries (now part of Henkel), John became Business Development Manager, North America before leaving to start the Printed Electronics business at Spraylat Corporation. For the past decade John was Global Business Manager for PPG's Electronic Materials business prior to joining SunRay Scientific in July of 2021.

## TRACK 4 – HIGH BRIGHTNESS ILLUMINATION BASED ON LASER LIGHT DIFFUSION WITH MIE SCATTERING

WEDNESDAY, OCTOBER 26

8:30AM–10:00AM

REGAL ROOM, FIRST FLOOR

**Abstract:** Stimulated emission as an alternative recombination mechanism is among possible solutions to overcome internal quantum efficiency (IQE) drop of light emitting diodes (LEDs) for high power density solid state lighting (SSL). Laser diodes (LDs) have shown to achieve higher power conversion efficiency (PCE) at high current densities. It is demonstrated that stimulated recombination maintains Auger droop in a constant range, allowing for high power density devices with PCE values comparable to LEDs under normal operating conditions. In addition, LDs offer narrow bandwidth light emission making them attractive solutions for SSL. Recently the efficacy of 254 lm/W was achieved in a phosphor converted LD illumination system utilizing boron nitride-coated copper foams, exceeding the expected efficacy of current LED based systems.

A concentrated beam from a LD must be broadened or diffused for efficient color conversion or color mixing for illumination purposes, all while maintaining low absorption. The speckle effect is also required to be minimized because of the interference of light waves of the same frequency due to the high spatial coherence of the LD beam to the eye detection level (<10%). Simple surface scattering (which provides low absorption opportunity in 10% range) is not suitable for speckle reduction of the LD beam and their scattering strength is low. A simple and cost-effective fabrication method is to use porous polymer film where diffusion is based on air/polymer refraction in 3D nano-porous polymer film. The refraction difference is only 0.4 and the diffuser was previously tested only on organic light emitting diodes (OLEDs), and not LDs. Other methods for LD beam diffusion are based on a dynamic ground glass diffuser which requires a moving method, susceptible to mechanical failure or efficiency and price rise. Here, for the first time, we are introducing a diffusion system based on Mie scattering from highly refractive TiO<sub>2</sub> particle (refractive index of 2.8 at 460 nm) inside silicone matrix (refractive index of 1.4) enclosed in a silver coated reflective cylindrical enclosure. The proposed design can be used for RGB laser color mixing and can prepare a uniform and almost with no speckle contrast for the color conversion system. A heat sink is grooved in shape of a LD tube and a reflective cylindrical container to guide the laser beam from an optical path (hole inside of the container) into the scattering domain. Container is filled with homogeneously scattered titanium dioxide micron scale particles inside optically clear silicone matrix. The laser beam, if not scattered by particles, will reflect from the walls and bottom side of the container to escape the container from top side to achieve a totally diffused light.

The Mie scatterings are modelled in LightTools environment based on Monte Carlo ray tracing. Based on Mie theory, software uses a well-known volumetric scattering theory to calculate the mean free path based upon the density of a distribution of spherical particles of given sizes with a given index of refraction. Reflectivity of the silver coated container is considered as 95%. Based on the entry angle of the laser beam ( $0 < \alpha <$

30°), volume density of the particles ( $\phi$ ), and particle diameters ( $2 \mu\text{m} < D < 10 \mu\text{m}$ ), the configuration with least optical power loss for a 20 mm diameter and 3 mm height container is determined. Later based on the phosphor modeling capability of the current system in color conversion systems are discussed.



**Ceren Cengiz**

Ceren Cengiz is a Ph.D. student in Mechanical Engineering at Virginia Tech University. In her master's education, she focused on thermal improvements of solid-state electronic devices. Currently, she studies the thermal characterization of acoustic holograms for therapeutic applications.



**Mohammad Azarifar**

Mohammad Azarifar is a Ph.D. student in Mechanical Engineering at Auburn University. His research focuses on the use of computational tools and experimental methods to characterize and improve the Opto-electro-thermal performance of solid-state electronics and lighting.

## TRACK 5 – FORM AND FUNCTION IN POWER ELECTRONICS: DRIVING PROGRESS IN EFFICIENT ENERGY CONVERSION BY MATCHED TECHNOLOGY-TOPOLOGY INTEGRATED DESIGN

**WEDNESDAY, OCTOBER 26**

**2:15PM–3:45PM**

**REGAL ROOM, FIRST FLOOR**

**Organizer:**

**Gilbert Moreno**, *NREL*

**Moderator:**

**Emre Gurpınar**, *Sikorsky Aircraft*

**Keynote Speaker:**

**Alberto Castellazzi**, *Kyoto University of Advance Science*

**Abstract:** The electrification of pivotal elements of our societal infrastructure is increasing the demand for energy in electrical form. In turn, that is generating significant R&D momentum in efficient energy processing. Modern power conversion systems rely fundamentally on solid-state devices to shape the transfer of energy between source and load according to set performance targets. In the semiconductor arena, disruptive progress has been made with the introduction of

wide-band-gap (WBG) technology, primarily silicon carbide (SiC) and gallium nitride (GaN). However, unleashing its full potential and justifying its higher costs in large volume deployment still require the development of bespoke packaging and circuit solutions. This talk will review learning done hitherto and discuss the way forward in the full exploitation of the superior features of WBG power devices.



**Alberto Castellazzi**,

*Kyoto University of Advance Science*

Alberto Castellazzi is a Professor in the KUAS Engineering Department, where he leads research and teaching in advanced solid-state power processing, including the characterization and use of wide-band-gap (WBG) semiconductor devices (silicon carbide, SiC; gallium nitride, GaN), their packaging and thermal management, to yield disruptive joint progress in efficiency, power density, and reliability of power converters. He holds a Laurea degree in Physics from the University of Milan, Italy, 1998, and a Ph.D. degree in Electrical Engineering from the Munich University of Technology (TU Munich), Germany, 2004, and has been involved in power electronics research and development for over 20 years, with affiliation and working experience both in industry and academia, including SIEMENS Corporate Technology (Germany), ETH Zurich (Switzerland), ALSTOM Transport (France), and The University of Nottingham (UK). Alberto has published over 200 papers in specialist international journals and conference proceedings and has held a number of invited talks, tutorials, and seminars on the topic of WBG power devices and SiC-based electrical power conversion. He is active as both a reviewer and editor and is a member of the technical program committee of a number of international conferences on power electronics and power semiconductor devices.

# Track Keynotes

## TRACK 8 – PAST AND FUTURE OF RELIABILITY ASSESSMENT OF ELECTRONIC MATERIALS

WEDNESDAY, OCTOBER 26

8:30AM–10:00AM

REGAL ROOM, FIRST FLOOR

**Organizer:**

Patrick McCluskey, *University of Maryland*

**Moderator:**

Pradeep Sharma, *University of Houston*

**Keynote Speaker:**

Patrick McCluskey, *University of Maryland*

**Abstract:** Prof. Abhijit Dasgupta has been a leader in modeling the reliability of electronic packaging materials for four decades from the 1990s to the 2020s. During his career, he has made major advancements in constitutive property determination, multi-scale modeling, lead-free solder joint reliability, aerosol jet printing, and characterization of additively manufactured materials, including his seminal work on Energy Partitioning. His students have gone on to hold leadership positions in academia and industry, including Department Chair at a major research university and Director of Reliability at Microsoft. And he has been a major force in the success of the annual InterPACK conference, serving for many years on the organizing committee.

In honor of Prof. Dasgupta, his former and current students have gathered to host a special mini symposium in the Reliability Track at this year's InterPACK conference. This keynote will highlight some of his major accomplishments in research, teaching, and service to this conference along with some anecdotes gleaned from working with him at the CALCE center for over 25 years. It will also discuss anticipated future developments in the reliability assessment of electronic materials that will grow from his foundational work.



**Patrick McCluskey,**  
*University of Maryland*

Dr. Patrick McCluskey is a Professor of Mechanical Engineering at the University of Maryland, College Park, and the Department's Director of Undergraduate Studies. He has over 25 years of research experience in the areas of thermal management, reliability, and packaging of electronic systems for use in extreme temperature environments and power applications. Dr. McCluskey has co-authored three books, 5 U.S. Patents, and nearly 200 peer-reviewed technical articles with over 3700 citations. He is an associate editor of the IEEE Transactions on Components, Packaging, and Manufacturing Technology, a member of the board of governors of the IEEE Electronic Packaging Society, a fellow and member of the Executive Council of IMAPS, and a member of ASME.

## TRACK 9 – BUILDING EXPLAINABLE AI FOR THE ENTERPRISE

THURSDAY, OCTOBER 27

8:30AM–10:00AM

REGAL ROOM, FIRST FLOOR

**Organizer:**

Azeem Sarwar, *General Motors*

**Moderator:**

Azeem Sarwar, *General Motors*

**Keynote Speaker:**

Krishna Gade, *Fiddler AI*

**Abstract:** Artificial Intelligence is increasingly playing an integral role in determining our day-to-day experiences. Moreover, with the proliferation of AI-based solutions in areas such as hiring, lending, criminal justice, healthcare, and education, the resulting personal and professional implications of AI are far-reaching. The dominant role played by AI models in these domains has led to a growing concern regarding potential bias in these models, and a demand for model transparency and interpretability.

Explainable AI has become a prerequisite for building trust and adoption of AI systems in high-stakes domains requiring reliability and safety such as healthcare and automated transportation, and critical industrial applications with significant economic implications such as predictive maintenance, exploration of natural resources, and climate change modeling.

In this talk, we will be talking about how Fiddler.AI is building an Explainable AI Platform that solves this problem by continuously monitoring AI algorithms for performance and bias issues and reports actionable insights with explanations to the entire organization. For more information, you can visit [www.fiddler.ai](http://www.fiddler.ai) or follow us on Twitter @fiddlerlabs.



**Krishna Gade,**  
*Fiddler AI*

For most of the last two decades, Krishna Gade spent time building scalable platforms at internet companies like Bing, Twitter, Pinterest, and Facebook to convert data into intelligent insights using big data, machine learning, and deep learning technologies. At Facebook, Krishna was leading the News Feed Ranking Platform that created the infrastructure for ranking content in News Feed and powered use-cases like Facebook Stories and recommendations like People You May Know, Groups You Should Join, etc. His team built Facebook's explainability features like Why am I seeing this? which helped bring much-needed algorithmic transparency and thereby accountability to the News Feed for both internal and external users. He is the co-founder and CEO of Fiddler AI. Fiddler AI is the first Explainable Monitoring solution for production AI systems, with the aim to build trust into AI by fully automating the monitoring and explainability of AI models in production.

## ROADMAPPING ADVANCED PACKAGING FOR ELECTRONICS MANUFACTURING, WITH INEMI

TUESDAY, OCTOBER 25

10:15AM–11:45AM

ROYAL E & F, FIRST FLOOR



**Shekhar Chandrashekhar**  
iNEMI

Dr. Shekhar Chandrashekhar has over 30 years' experience as a leader, strategist, and innovator with a history of driving improvements that streamline operations, drive growth, and increase profitability on a global scale. His background in business and technology leadership, and his deep knowledge and advanced training in engineering management, have provided him with a unique talent—the ability to transform organizations, influence product positioning and drive a laser focus on priorities that support the company's vision and goals.

Prior to joining iNEMI, Shekhar was responsible for managing the national network of Smart Manufacturing Innovation Centers (SMICs) for the Clean Energy & Smart Manufacturing Institute (CESMII). In this role, he worked with the SMICs to demonstrate the value of deploying Industry 4.0 solutions to the manufacturing industry. Similarly, with California Manufacturing Technology Consulting, he oversaw the implementation of Industry 4.0 and digital technology solutions, building a network of systems integrators that impacted more than 35,000 small and medium sized manufacturers in California in their deployment of smart manufacturing solutions.

He has also worked with the American Society of Mechanical Engineers (ASME) as managing director, programs, for the association's executive leadership team. In that role, he led business strategy development and created a program portfolio focused on workforce and global development. He helped influence the global engineering community by constructing and implementing content strategies to drive quality, innovation and revenue growth.

Shekhar began his career as a member of technical staff of AT&T Bell Labs and held several management positions with Bell Labs/Lucent Technologies/Alcatel-Lucent, including senior manager for the Network Solutions Group and Bell Labs/Supply Chain Networks. He eventually became director of the company's CTO Group, where he created the footprint for Global Engineering Centers and optimized supply chain and operations for 20 business divisions in 40 countries.

He received the Advanced Technology Excellence Award from Bell Laboratories and the Outstanding Young Manufacturing Engineer Award from SME. He is a member of the editorial board for the International Journal of Concurrent Engineering Research and Applications and has published over 25 papers in international journals and conferences. Shekhar has a Ph.D. in Mechanical Engineering from Concordia University (Montreal, Canada) and a Bachelor of Technology degree in Mechanical Engineering from the Indian Institute of Technology (Mumbai).



**Francis Mullany**  
iNEMI

Dr. Francis (Frank) Mullany came to iNEMI from a long career at Nokia Bell Labs, where he was most recently a research strategist in Bell Labs Research, working with lead researchers to define roadmaps, research strategy and technology marketing. His 20 years of managerial and technical experience spans a broad range of wireless and networking technologies, from RF hardware to network slicing, and from real-time machine-learning inference engines to end-to-end orchestration. Frank joined Bell Labs in 1998, first with the Wireless Research Laboratory in the UK and then he helped establish Bell Labs Ireland in Dublin in 2004. He built up and led the RF Antennas and Front-End Technologies department focusing on novel RF technologies and hardware. In 2013, Frank established Bell Labs' Internet of Things research program before moving to the CTO organization to lead the Network Compliance, Reliability, Security and Corporate Standards organization. In 2015, he returned to Bell Labs Research to take up a research strategy role. Frank was Alcatel-Lucent's representative on EPoSS, the European smart system industry association, and was the editor for the telecommunications section of the EPoSS Strategic Research Agenda. He received B.E. and Ph.D. degrees in Electronic Engineering from University College Dublin, National University of Ireland.

## MICROELECTRONIC AND ADVANCED PACKAGING TECHNOLOGIES

TUESDAY, OCTOBER 14

2:15PM–3:45PM

ROYAL E & F, FIRST FLOOR



**Todd Younkin**  
SRC

In August of 2020, Dr. Todd Younkin became the CEO of SRC, where he leads a ~\$90M/yr. global research agenda supported by ~3k academic and industrial researchers, 26 international companies, and 3 U.S. government agencies. Shortly thereafter, SRC released its 2030 Decadal Plan for Semiconductors, where it identified the five “seismic shifts” shaping the future of information and communication technologies (ICT). Working closely with SIA, SRC has called for greatly increased federal investments throughout the decade to establish a smarter pipeline for semiconductor R&D, aligned to SRC's Decadal Plan. Prior to becoming SRC's CEO, Dr. Younkin's research and development experience spanned Intel's 0.18 um to 5 nm nodes with technical contributions in novel materials, nanotechnology, integration, advanced lithography, and integrated photonics.

# Workshops

From 2010 to 2013, Dr. Younkin was on assignment to IMEC's advanced lithography program to mature both EUV lithography (EUVL) and the Directed Self-Assembly (DSA) of block copolymers (BCPs) and return the technology to Intel in Portland, OR. In 2018, Dr. Younkin engineered, launched, and led all programmatic aspects of the 5-year, \$250 million JUMP research initiative, led by the Semiconductor Research Corporation (SRC) in collaboration with DARPA and their Electronics Resurgence Initiative (ERI). JUMP has 6 multi-university, multi-disciplinary innovation centers that bring together 140 faculty, 701 students, and 387 industrial engineering liaisons on 172 research tasks at 32 universities. It emphasizes the advancement of Materials, Electrical Engineering, and Computer Engineering to secure continued U.S. thought leadership in semiconductors.

Dr. Younkin holds a Ph.D. from the California Institute of Technology in Pasadena, California. He completed his Bachelor of Science at the University of Florida in Gainesville, Florida.

## INTRODUCTION TO ROBOTICS, AI, AND INTEL'S OPENVINO TOOLKIT WORKSHOP

WEDNESDAY, OCTOBER 26

2:15PM-3:45PM

TERRACE D-F, FIRST FLOOR

**Abstract:** Have fun as you learn about virtual robotics using Coderz platform, AI using Jupyter notebooks, and Intel's OpenVINO toolkit™, with this introductory course. From understanding sensors to programming missions, this course will equip you with virtual coding experience in programming robots or drones and understanding AI. No robot required. No prior experience required. A laptop with internet access and Chrome browser will do. This course will also enable you to set up after-school robotics/AI clubs for your local community children. These lessons are taught by award winning teams from Education Empowers Inc. (501 (c) non-profit) as well as Intel Industry professionals.

*Be the first 30 to register and receive an Intel Movidius Neural Compute Stick (NCS2, \$70 value) and access to CoderZ for a year, from Education Empowers Inc. [www.educationempowers.org](http://www.educationempowers.org)*

### Presenters:

**Stewart Christie**, Intel Corporation and Education Empowers Inc.

**Anna Prakash**, Intel Corporation and Education Empowers Inc.

**Elaina Ashton**, Arizona State University and Education Empowers Inc.

**Veronica Tanner**, Southern Methodist University and Education Empowers Inc.



**Stewart Christie**,  
Intel Corporation

Stewart Christie is an AI/IoT Evangelist in the Developer Enabling Team at Intel. His day job includes developing demos and teaching classes on AI Enhanced Computer Vision, primarily for use in the Retail and Hospitality industries, including remote management and digital signage use cases. Stewart is focused on the software side of the ecosystem, guiding developers building Inference at the Edge Applications in C/C++ and Python. He is an expert in the deployment of the Intel Distribution of OpenVINO™ Toolkit, and the vPRO/AMT software solutions. While not working at Intel, Stewart plays with cameras, and robots, and builds robots with cameras. For his dedication and community outreach, Stewart has received the prestigious Presidential Service Awards.

You can follow Stewart on twitter @intel\_stewart, and follow the robots on twitter@dalekleo





**Anna Prakash,**  
*Intel Corporation*

Anna Prakash, Intel Corporation, began her engineering career working on LCDs, HDTVs, and handheld communication devices. She joined Intel in 2004 as a Packaging R&D Engineer, focusing on automotive components, microLEDs, and Aurora super computers. Anna has several patents and papers covering sensors and semiconductor packaging materials and process. Outside of work, Anna is passionate about promoting STEM education for local children. Along with her daughter Elaina, she co-founded Education Empowers Inc. ([www.educationempowers.org](http://www.educationempowers.org)), a non-profit, to promote STEM education. Anna is the recipient of the 2019 Intel Hero award, Society of Women Engineers "Prism Award," and the IEEE STEM outreach award for her contribution to technology and the community.



**Eliana Ashton,**  
*Arizona State University*

Elaina Ashton is an Electrical Engineering student at Arizona State University, Tempe, Arizona. As a STEM Ambassador for Education Empowers Inc., she spends her weekends teaching robotics for girls and underserved children living in the Arizona community. For her dedication to STEM outreach, she received the Cox connect2STEM award, 18 under 18 award, and the Chandler Mayor's Youth of the Year award.



**Veronica Tanner**

Veronica Tanner is a junior studying Computer Science and minoring in Chinese at Southern Methodist University. She is a STEM Ambassador for Education Empowers Inc. She has experience in cybersecurity research and interests in software engineering and artificial intelligence.

## K16 PROFESSIONAL DEVELOPMENT & MENTORING WORKSHOP

**THURSDAY, OCTOBER 27**

**4:00PM–5:30PM**

**SEVILLE ROOM, SECOND FLOOR**

### Organizers:

**Ronald Warzoha, Darshan G. Pahinkar, Ash Giri, and Adam Wilson**

The K-16 Mentorship Program offers current graduate students, post-docs, and junior scientists the opportunity to engage with mentorship through a series of presentations and interactions with seminal contributors in the field. This mentoring activity not only gives mentees exposure to a wider network of successful peers but also gives them a perspective of their progress from an outsider's standpoint.

In this workshop, three distinguished members of the electronics packaging community will deliver brief presentations on their experiences with mentorship, recommendations for how to engage in mentorship activities with senior-level members of the community, and best practices for engaging in mentor-mentee relationships. After their presentations, time will be reserved for members of the audience to meet with panelists at round tables, both to ask questions and discuss future mentorship activities.

### Panelists:



**Dereje Agonafer,**  
*University of Texas, Arlington*

Dereje Agonafer is a Presidential Distinguished Professor in MAE at UT Arlington. He heads two centers and his current primary research areas are in the energy efficiency of data centers and electronic packaging with a special focus on heterogeneous integration. Before joining academia, he worked at IBM, and in 1991, he received the "IBM Outstanding Technical Achievement Award in Appreciation for Computer Aided Thermal Modeling." Since joining academia in 1999, he has graduated over 250 graduate students including 31 PhDs. He is currently advising 15 PhDs and several MS students. He has won numerous awards, including 2021 Lifetime Achievement Award by the SEMI-THERM Educational Foundation Thermal Hall of Fame; the award is in "Recognition of Significant Contributions to the Field of Electronics Thermal Management"; 2019 Heat Transfer Memorial Award; 2014 ITherm Achievement Award; 2014 NSBE Golden Torch Award honoree for Golden Torch Legacy; 2009 InterPACK Achievement Award, and 1998 Distinguished Alum – UC Boulder. He is a Fellow of AAAS, Life Fellow of ASME, and Life Fellow of the NAI. In 2019, he was elected to the National Academy of Engineering where he currently chairs two committees. In March 2020, Professor Agonafer was presented the Howard University Alumni Award for Distinguished Postgraduate Achievement in the field of Engineering at the 153rd Charter Day Dinner. Professor Agonafer is married to his wife Carolyn, and they

## Workshops

have two children; a son, Dr. Damena Agonafer who is Professor of Mechanical Engineering at the University of Maryland, College Park, and a daughter, Dr. Senayet Agonafer, a Regional Chief Radiologist at Lennox Hill Radiology in New York City.



**Amy Marconnet,**  
*Purdue University*

Amy Marconnet is an associate professor of Mechanical Engineering and a Perry Academic Excellence Scholar at Purdue University. She received a B.S. in Mechanical Engineering from the University of Wisconsin – Madison in 2007 and an M.S. and a Ph.D. in Mechanical Engineering at Stanford University in 2009 and 2012, respectively. Her dissertation focused on thermal phenomena in nanostructured materials. She then worked briefly as a postdoctoral associate at the Massachusetts Institute of Technology, before joining the faculty at Purdue University in August 2013. She was promoted to associate professor with tenure in August 2019. Her group's work at Purdue focuses on heat transfer and energy conversion with applications ranging from electronics packaging to aerospace to energy and water. From August 2021 to May 2022, she was a Humboldt Fellow at the Karlsruhe Institute of Technology working on understanding the degradation in thermal properties of battery cells with aging.



**Victor Chiriac,**  
*Global Cooling Technology Group, LLC*

Victor Chiriac is the co-founder, CEO, and Managing Director of Global Cooling Technology Group and has made outstanding industry-wide contributions to the cooling of electronic packages and mobile/portable consumer electronic devices. He is a Fellow of the American Society of Mechanical Engineers and has held technology/engineering leadership roles, led corporate thermal technology teams and roadmaps, working on leading-edge mobile/wireless technologies with Motorola (1999–2010), Qualcomm (2010–2018), and Futurewei/Huawei R&D USA (2018–2019). Dr. Chiriac was elected Chair of the ASME K-16 Electronics Cooling Committee and was elected the Arizona and New Mexico IMAPS (International Microelectronics and Packaging Society) Chapter President in 2010. He is a co-editor of Electronics Cooling Magazine since 2016 and a leading member of the organizing committees of ASME/InterPack, ASME/IMECE, and IEEE/CPMT ITherm Conferences. He has 19 U.S.-issued patents, 1 U.S. Trade Secret, 1 U.S. Defensive Publication, and has published over 107 papers in scientific journals and at international conferences. He received his Ph.D. (1999) in Aerospace and Mechanical Engineering from the University of Arizona, Tucson, AZ, USA.

## TUTORIAL 1 (TRACK 4) – NANOPHOTONIC SYSTEMS: NOEL NANOPHOTONICS DEVICE AND FUTURE APPLICATIONS IN ELECTRONICS

WEDNESDAY, OCTOBER 26

10:15AM–11:45AM

SEVILLE ROOM, SECOND FLOOR

**Organizer:**

Anil Yuksel, *IBM Corporation*

**Moderator:**

Jason Valentine, *Vanderbilt University*

**Presenter:**

Jason Valentine, *Vanderbilt University*

**Abstract:** This tutorial will provide an introduction to the emerging field of nanophotonics, integrated photonics, and meta-optics for applications in next generation opto-electronics, thermal systems, and computational devices. The ability to design and fabricate sub-wavelength structures in these devices provides an unprecedented capability of shaping optical and thermal wave propagation, and thus presents an interesting opportunity to create ultra low-power and efficient computational systems.



Jason Valentine,  
*Purdue University*

Professor Valentine received a B.S. in mechanical engineering from Purdue University in 2004 and a Ph.D. in mechanical engineering from UC Berkeley in 2010. He is currently an Associate Professor of Mechanical Engineering at Vanderbilt University and the Deputy Director of the Vanderbilt Institute of Nanoscale Science and Engineering (VINSE). Prof. Valentine's research focuses on optical metamaterials and their use in imaging and image processing, photodetection, and dynamically reconfigurable optics for wavefront control. Dr. Valentine's work was selected by Time Magazine as one of the "Top 10 Scientific Discoveries in 2008" and he has received an NSF CAREER Award and the Office of Naval Research Young Investigator Award as well as a Chancellor's Award for Research.

## TUTORIAL 2 (TRACK 6) – ADVANCED LIQUID-COOLING TECHNOLOGY FOR ICR: PERFORMANCE AND ECONOMIC BENEFITS

WEDNESDAY, OCTOBER 26

8:30AM–10:00AM

SEVILLE ROOM, SECOND FLOOR

**Organizer:**

Ronald Warzoha, *United States Naval Academy*

**Presenter:**

Raffaele Luca Amalfi

**Abstract:** Data processing, transport and storage demands are exponentially increasing, driven by applications in mobile broadband, video/gaming, cloud, 5G networks, Artificial Intelligence (AI), and Internet of Things (IoT). This has profound implications in terms of overall system design with the associated general trend towards achieving greater system functionality per unit volume. Thermal management will be the key to enable these densification challenges and meet ESG goals. In this tutorial, I will discuss performance and economic benefits of direct-to-chip passive liquid-cooling technology, as a long-term solution to scale existing hardware platforms and build high-performance data centers and telecom installations, while being environmentally-friendly.



Luca Amalfi,  
*SEQUENTE*

Dr. Luca Amalfi is the CEO and Co-Founder of SEQUENTE, LLC and former Principal Innovator at Nokia Bell Labs US, where he led R&D activities in the field of thermal management of high-performance communications and computing systems. Since 2016, he worked as a Scientific Collaborator and Laboratory Operations Manager at the Swiss Federal Institute of Technology of Lausanne in Switzerland (EPFL). In 2015, he joined Alcatel-Lucent US, where he performed disruptive research on liquid cooling technologies for network equipment. In 2012, he joined IBM Research Lab in Switzerland, where he developed a novel cooling system for high-performance servers. He received a Ph.D. in Energy Engineering from the EPFL and authored over 55 scientific publications in leading journals, conference proceedings, and handbooks. Dr. Amalfi is a Member of the ASME K-16 Heat Transfer Committee, Member of the OCP Heat Reuse Steering Committee, Guest Editor for the ASME Journal of Electronic Packaging, and recipient of numerous IEEE and ASME Awards.

## TUTORIAL 3 (TRACK 7) – OPTIMIZATION OF BATTERY RECYCLING FOR SUSTAINABILITY

THURSDAY, OCTOBER 27

8:30AM–10:00AM

SEVILLE ROOM, SECOND FLOOR

**Organizer:**

**Nenad Miljkovic**, *University of Illinois at Urbana-Champaign*

**Moderator:**

**Jarom Sederholm**, *University of Illinois at Urbana-Champaign*

**Presenters:**

**Ilias Belharouak**, *Oak Ridge National Laboratory*

**Zheng Chen**, *University of California, San Diego*

**Abstract:** Current projections of future battery usage show that critical battery materials including cobalt, lithium, and nickel will become increasingly scarce over the next few decades. In response, battery recycling and battery materials recovery have become an issue of greater interest and importance. This tutorial will feature several battery recycling methods including hydrometallurgical, pyrometallurgical, and direct recycling along with an explanation of the key issues surrounding lithium-ion battery recycling. The speakers will cover common materials and methods, the best situations of utilization, and the current limitations and drawbacks of each method with a focus on safety, materials recovery, and industrial viability. Finally, current and future research surrounding battery recycling will be used to highlight how current progress can be applied to solve the impending problem of sustainable battery materials acquisition.



**Ilias Belharouak**,  
*Oak Ridge National Laboratory*

Dr. Ilias Belharouak is a Distinguished Scientist and Head of the Electrification Section in the Electrification and Energy Infrastructure Division at Oak Ridge National Laboratory. Before joining ORNL in November 2017, Dr. Belharouak was a Research Director and the Founding Chief Scientist of the Electrochemical Energy Storage Group in the Qatar Environment and Energy Research Institute (QEERI), between 2013 and 2017. He was a Professor at the Hamad Bin Khalifa University (HBKU), a member of Qatar Foundation, between 2015 and 2017. He was a Material Scientist and Battery Expert in the Chemical Sciences and Engineering Division at Argonne National Laboratory, between 2001 and 2013.



**Zheng Chen**,  
*UCLA*

Zheng Chen received his Ph.D. at UCLA in 2012 under the supervision of Prof. Yunfeng Lu in the Department of Chemical and Biomolecular Engineering. His Ph.D. work is mainly related to design and synthesis of nanostructured materials for electrochemical energy storage devices. From 2013 to 2016, he was a postdoctoral associate working with Prof. Zhenan Bao in Chemical Engineering and Prof. Yi Cui in Materials Science and Engineering at Stanford University, where his work focused on functional polymer materials for enhanced energy density, longer cycling lifetime, and improved safety of batteries. Zheng Chen's research focuses on development of novel nanostructured and polymeric materials for cutting-edge applications including electrochemical energy devices (batteries, supercapacitors, and fuel cells), flexible and printable devices, and sustainable water and resources.

## TUTORIAL 4 (TRACK 8): RECIPE FOR HETEROGENOUS INTEGRATION PACKAGING ROADMAPING

TUESDAY, OCTOBER 25

8:30AM–10:00AM

SEVILLE ROOM, SECOND FLOOR

Reliability Needs and Responses of HI Stakeholders - ?

**Session Chair:**

**Abhijit Dasgupta**, *University of Maryland*

**Session Co-Chair:**

**S.B. Park**, *The State University of New York (SUNY) at Binghamton*

**Presenters:**

**S.B. Park**, *The State University of New York (SUNY) at Binghamton*

**Amr S. Helmy**, *University of Toronto*

**Abhijit Dasgupta**, *University of Maryland*

**Abstract:** The Heterogeneous Integration Roadmap (HIR) is a roadmap to the future of electronics, identifying technology requirements, and potential solutions in a post-Moore world. The primary objective is to stimulate pre-competitive global collaboration between industry, academia, and government to accelerate progress. The roadmap offers professionals, industry, academia, and research institutes a comprehensive, strategic forecast of technology over the next 15 years. The HIR also delivers a 25-year projection for heterogeneous integration of Emerging Research Devices and Emerging Research Materials with longer research-and-development timelines. The HIR is sponsored by three IEEE Societies (Electronics Packaging Society, Electron Devices Society, and Photonics Society) together with SEMI and ASME EPPD.

Session I of this HIR Tutorial will deal with the near-term as well as far-term reliability challenges and needs faced by the six major application segments identified in the HIR Roadmap. These include: (i) Aerospace and Defense; (ii) Automotive; (iii) High Performance Computing and Data Centers; (iv) Medical, Health and Wearables; (v) Mobile; and (vi) IoT.

Session II of the tutorial will address the opportunities and challenges associated with integrating photonics into the package to benefit applications ranging from compute, sensing, and data interconnection between modules. This section will discuss the near-term as well as long-term challenges and needs for incorporating photonics into CMOS packages.

The third session will present the phased vision and activities that are being formulated and proposed by the Reliability Technology Working Group in the HIR Team, as the pan-industry global approach needed to meet the reliability needs of the relevant stakeholders. This vision will be presented in terms of goals and milestones for the short-horizon (1–5 years); mid-horizon (5–10 years), and far-horizon (10–15 years) time-scales. The purposes for this HIR tutorial are to elicit audience interest, solicit voluntary participation from the community in the HIR activities, and to stimulate collaboration among HIR stakeholders around the world.

The tutorial will also discuss the multi-physics skills needed for the workforce to be successful in future heterogeneous integration activities.



**Seungbae (SB) Park,**  
*State University of New York at Binghamton*

Prof. Seungbae (SB) Park is a Professor of mechanical engineering of the State University of New York at Binghamton. He is also the director of Integrated Electronics Engineering Center (IEEC), a New York State Center for Advanced Technology (CAT). Professor Park is an expert in Modeling and Simulation for electronics components and systems integration. His contributions have been recognized with many international awards and citations. He has contributed in various advanced packaging, including 2.5D/3D package development, MEMS packaging, reliability assessment of assemblies and systems, and smart electronics manufacturing. He has more than 200 technical publications and holds four U.S. patents. Dr. Park was elected as an ASME Fellow, Chair of IEEE Electronic Packaging Society Thermal/Mechanical Technical Committee, Executive Committee of ASME Electronics and Photonics Packaging Division, Chair of ASME K-16 Committee on Heat Transfer in Electronic Equipment, and served as an associate editor for the ASME Journal of Electronic Packaging. Professor Park has been helping consumer electronics and packaging companies as a consultant.



**Abhijit Dasgupta,**  
*University of Maryland*

Abhijit Dasgupta is Jeong H. Kim Professor of Mechanical Engineering at the University of Maryland (UMD), with research experience in the microscale and nanoscale mechanics and reliability physics of engineered materials used in conventionally and additively manufactured heterogeneous flexible electronic systems and intelligent microsystems. He holds a Ph.D. in Theoretical and Applied Mechanics from the University of Illinois at Urbana-Champaign (UIUC), and has been a principal investigator at the Center for Advanced Life Cycle Engineering (CALCE) at UMD for over 30 years, conducting research in reliability physics, design for reliability, accelerated stress testing, and real-time health management. He has published over 300 articles and conference papers, served on editorial boards of three international archival journals, presented over 50 workshops and short courses, helped form research and educational roadmaps for the electronics industry, and provided consulting services to numerous industry leaders. He has presented numerous keynote talks at international conferences, received six best-paper awards and received eight major awards in recognition of his research and educational contributions. He is an ASME Fellow, past Chair of the ASME Electronic and Photonic Packaging Division (EPPD), past member of the ASME Design, Manufacturing and Materials Segment Leadership Team (DMM-SLT), and Current Chair of Reliability Technology Working Group in the Heterogeneous Integration Roadmap (HIR) Team sponsored by IEEE/ASME/SEMI/IEPS/EDS. He regularly reviews technical papers in microelectronics journals, such as ASME Journal of Electronic Packaging, IEEE CPMT, Microelectronics Reliability, and Journal of Electronic Materials. He has held various leadership roles in such conferences as ASME InterPACK, IEEE ITherm, IEEE Eurosime, and IEEE REPP.



**Amr S. Helmy,**  
*University of Toronto*

Dr. Amr S. Helmy is a professor in the department of electrical and computer engineering at the University of Toronto. Prior to his academic career, Amr held a position at Agilent Technologies - UK, between 2000 and 2004. At Agilent his responsibilities included developing lasers and monolithically integrated optoelectronic circuits. He received his Ph.D. and M.Sc. from the University of Glasgow with a focus on photonic fabrication technologies, in 1999 and 1994, respectively. He received his B.Sc. from Cairo University in 1993, in electronics and telecommunications engineering science. His research interests include photonic device physics and characterization techniques, with emphasis on plasmonics and nonlinear and quantum photonics.

# Panel Sessions

## PANEL 1: WOMEN IN ENGINEERING

TUESDAY, OCTOBER 25

8:30AM–10:00AM

ROYAL E & F, FIRST FLOOR

**Panel Summary:** The Panel on “Women in Engineering” will be composed of exemplary female educators and industry leaders who will discuss their career paths and challenges as well as their advice to younger females. Thriving while preserving through STEM journey can be hard. These extraordinary women will share their journey, career paths, constantly evolving with different challenges, uncertainties, frustrations, and setbacks but to emerge as leaders in their fields of Engineering, Science, and Technology. The goal of this session is to share reflections, challenges, and practical actions to empower you through your STEM journey. The panel will have representation from a wide range of educators from university level and leaders from industries

**Panel Moderator:**

**Anna Prakash, Ph.D.,** *Principal Engineer, Intel*



**Anna Prakash,**  
*Intel*

Anna Prakash, Ph.D., Principal Engineer, Intel Corporation, began her engineering career working on LCDs, HDTVs, and handheld communication devices. She joined Intel in 2004 as a Packaging R&D Engineer, focusing on automotive components, microLEDs, and Aurora super computers. Anna has several patents and papers covering sensors and semiconductor packaging materials and process. Outside of work, Anna is passionate about promoting STEM education for local children. Along with her daughter Elaina, she co-founded Education Empowers Inc., ([www.educationempowers.org](http://www.educationempowers.org)), a non-profit, to promote STEM education. Anna is the recipient of the 2019 Intel Hero award, Society of Women Engineers “Prism Award” and the IEEE STEM outreach award for her contribution to technology and the community.

**Panelists:**

**Sriya Sanyal, Ph.D.,** *Program Manager, Becton Dickinson*  
**Shamala Chickamenahalli, Ph.D.,** *Arizona State University, Intel*  
**Saskia Christian,** *Sr. Supply Chain Professional, Intel*  
**Shirley Ekbundit, Ph.D.,** *Program Manager, NXP Semiconductors*  
**Joyce Weiner,** *Principal Engineer, AI Software Architecture, Intel*



**Sriya Sanyal,**  
*Becton Dickinson*

Dr. Sriya Sanyal supports the successful development and launch of key Omni-channel campaigns through the application of scrum and agile ways of working to deliver an exceptional customer experience while unlocking value for Becton Dickinson (BD) a medical devices company. Sriya also provides Program Management support to strategic customer and digital projects.

Sriya joined BD from Amazon Canada, where she held the position of Operations Manager and led a large team while driving operational improvements and associate engagement. Sriya’s previous experience includes roles in Market Development (Turows Inc.), Product Development (Diodes FabTech), and Process Technology Development (Intel Corporation).

Sriya’s academic achievements include a Bachelor of Technology, Chemical Engineering from the National Institute of Technology in Durgapur, India, a Ph.D in Chemical Engineering from Arizona State University, and an MBA from Schulich School of Business, York University. Sriya’s work has been published in peer-reviewed journals, and she is a research grant recipient from the Society of Women Engineers. In addition, Sriya recently obtained the Certified Scrum Master (CSM) certification.



**Shirley Ekbundit,**  
*NXP Semiconductors*

Dr. Shirley Ekbundit has been working at NXP Semiconductors for 24 years. Her current position is a Program Manager overlooking the factory’s quality systems, such as FMEA (Failure Mode and Effect Analysis) and MSA (Measurement System Analysis). In addition, she is also a lead in setting up training for Engineers at CHD fab.

Prior to these roles, she was a process engineer with specialty in Diffusion Processing. She is skilled on both the process side and equipment side of this part of semiconductor fabrication. She is currently a green belt in 6-sigma program and is pursuing a black belt. Her experience in six-sigma includes FMEA, MSA, 8D, and 3x5 Why’s,

Shirley graduated from Arizona State University with a Ph.D. in Solid State Chemistry with emphasis on solid-to-solid phase transition of material at extreme pressure. Her bachelor’s degree was in Chemistry, also from Arizona State University.



**Shamala Chickamenahalli,**  
*Intel and Arizona State University*

Dr. Shamala Chickamenahalli is currently platform applications engineer at Intel addressing customer power delivery issues on Intel reference designs. Concurrently, Shamala is Professor of Practice at Arizona State University where she taught Electrical Engineering since 2015. From 1999 to 2015, Shamala was Senior Packaging Engineer and Process Engineer at Intel Chandler focusing on strategic power delivery solutions from the motherboard to the CPU. From 1994 to 1999, Shamala was Assistant Professor at Wayne State University, Detroit, MI. Shamala received her Ph.D. in EE from the University of Kentucky, Lexington; Masters from IIT Kharagpur India; and Bachelors in EE from Bangalore University in India. Before arriving in the U.S., Shamala worked in an Indian defense lab as an EMI/MEC Scientist and in the electrical machines and drives R & D industry for five years. In her spare time, Shamala teaches Indian classical music to community members and volunteers for the IEEE, the community locally, nationally, and internationally, and mentors youth on various topics.



**Saskia Christian,**  
*Intel*

Saskia Christian is a strategic technical leader, visionary, and mentor with 17+ years of professional experience across Intel chip manufacturing, facilities, and supply chain operations. She is a Certified Project Management Professional (PMP) with Bachelor's/Master's Chemical Engineering specialization. She is also branded as a water treatment and environmental sustainability enthusiast immersed in the Global Fab Materials Supply Chain world as Senior Strategic Quality Engineer. She is an avid driver of STEM professional and youth technologists nurturing and recruitment. As a Pioneer of Intel TD facilities mechanical industrial cooling water treatment program, she led the integration of multiple bioremediations and environmentally friendly technologies for facilities mechanical cooling water systems. Her graduate research completed at NJIT (New Jersey Institute of Technology) Center for Membrane Technologies is in the application of novel polymeric heat exchangers for thermally driven desalination processes. Her STEM career story was also featured in the first Intel sponsored STEM connector ebook, *Connecting the World is STEM*.



**Joyce Weiner,**  
*Intel*

Joyce Weiner is a Principal Engineer, AI Software Architecture at Intel Corporation. As a Lean expert and Data Scientist, she focuses on using data to drive change and improve efficiency. Joyce is currently working on projects to use AI to assist system designers, and to unlock insights from text fields. Her book, *Why AI/Data Science Projects Fail: How to Avoid Project Pitfalls*, was published in 2021. Joyce has a BS in Physics from Rensselaer Polytechnic Institute and an MS in Optical Sciences from the University of Arizona. She is married and in her free time enjoys drawing, calligraphy, and reading.

## PANEL 2: IMPACT OF SUSTAINABILITY GOALS ON FUTURE HARDWARE AND DATA CENTER

**THURSDAY, OCTOBER 27**

**10:15AM-11:45AM**

**IMPERIAL ROOM, FIRST FLOOR**



**Panel Moderator:**  
**Cheng Chen, Meta, Inc.**

Dr. Cheng Chen received his doctorate degree from SUNY Binghamton. He is currently a Hardware Thermal Engineer at Meta. Dr. Chen has been focusing on thermal architect design of server platforms, and exploration into advanced cooling technologies at different scales. He is also an active member of OCP contributing to AI/ML products and liquid cooling solutions.

**Panel Summary:** Sustainability goals are becoming increasingly important for hyper scale data centers. They are imposing restrictions on how to design, manufacture, and operate server hardware in large scale infrastructures, and urging evolution of more capable, efficient, and environmentally friendly cooling technologies. On the other end, there's extra pressure from an ever-growing need to increase electronics power and density, which impacts the power and water usage. In this panel session, experts from Meta, Nvidia, ARPA-E, TMGCore, and IBM will introduce their perspectives towards sustainability and cooling technologies, and how those requirements would influence future hardware and data centers to evolve.

# Panel Sessions

## Panelists:

**Tiffany Jin**, *Meta, Inc.*

**Jimil Shah**, *TMGcore*

**Peter De Bock**, *DOE*

**Pritish Parida**, *IBM*

**Ali Heydari**, *Nvidia*

## Presentation Title:

The Need for More Transparency in Data Collection and Life Cycle Assessments, and Design for Circularity



**Tiffany Jin**,  
*Meta*

Tiffany Jin is a mechanical engineer and sustainability tech lead for data center hardware design at Meta. She is currently the co-chair of the Sustainability workstream within OCP, and previously initiated the OAM form factor and OAI workstream. She has also led the mechanical design of multiple programs across Meta's hardware infrastructure, including AI/ML systems such as Zion and 2S systems such as Tioga Pass. Tiffany holds a BS and MS in Mechanical Engineering from MIT and Stanford, respectively.

## Presentation Title:

Challenges and Opportunities in Data Center Design and Development in the Age of AI



**Ali Heydari**,  
*Nvidia*

Ali Heydari is a Distinguished engineer and Data Center Technologist at Nvidia in charge of all data center cooling technology development. He is developing direct to chip liquid cooling technologies using cold plates, cooling distribution units, and manifolds for Nvidia's high heat density data centers. Prior to Nvidia, he worked as senior director in charge of Rigetti's Quantum Computers using the most futuristic technology in today's data center compute. Prior to that he served as Senior Technical Director and Chief Data Center Architect at Baidu, the largest search engine and AI company in China. He was server and data center architect in charge of hardware and data center design, development, and deployment in China's largest data center search and AI company. Formerly, he was Senior Hardware Engineer at Twitter, where he was responsible for grounds up development of Twitter's data center ODM server development. Earlier, he was Senior Hardware Engineer at Facebook, where he helped in developing Facebook's original OCP server and data center products. Prior to that he worked at Sun Microsystems and spent about 10 years as Associate Professor of Mechanical Engineering at Sharif University of Technology in Iran. He received his B.S. in mechanical engineering from University of Illinois, Urbana, M.S., Ph.D. in mechanical

engineering, and M.A. in applied mathematics from University of California, Berkeley. He has over 25 issued patents in data center cooling technologies.

## Presentation Title:

Government Support Efforts for Transformational Advances in Technologies for More Energy Efficient Computing



**Peter de Bock**,  
*Advanced Research Projects Agency-Energy (ARPA-E)*

Dr. Peter de Bock currently serves as Program Director at the Advanced Research Projects Agency-Energy (ARPA-E) for the U.S. Department of Energy. At ARPA-E, he manages and supports teams in zero-carbon hybrid aviation propulsion systems through the ASCEND program and other projects related to the efficiency of electronic and thermal systems such as Data Centers. Prior to joining ARPA-E, Dr. de Bock worked at GE Research as Principal Engineer Thermosciences. He is the former chair of the ASME K-16 committee on Heat Transfer in Electronics equipment and holds 50+ patents and publications. Dr. de Bock received his Ph.D. in Mechanical Engineering from the University of Cincinnati and holds MSc degrees from University of Twente in the Netherlands and University of Warwick in the UK.

## Presentation Title:

Impact of immersion Cooling on Emissions, Water and Power Utilization



**Jimil Shah**,  
*TMGcore*

Dr. Jimil M. Shah is a Senior Director of Thermal Sciences at TMGcore. Before joining TMGcore, he was an Application Development Engineer for Server Liquid Cooling of Data Centers at 3M Company. His research in advanced cooling solutions for data center thermal management focuses on single- and two-phase direct-to-chip as well as immersion cooling using dielectric fluids. Before joining 3M, Dr. Shah worked as a Post-Doctoral Research Associate at The University of Texas at Arlington.

Dr. Shah received his doctorate in Mechanical Engineering from The University of Texas at Arlington in 2018 and is a professional member of IEEE, ASHRAE TC9.9, ASME, and OpenCompute. In the InterPACK 2018, he received the "ASME Electronic and Photonic Packaging Division (EPPD) Student Engineer of The Year Award." He has published 28 journal and conference papers with one additional article under review.



**Presentation title:**

Sustainable Computing – Challenges and Opportunities



**Pritish Parida,**  
IBM

Dr. Pritish Parida is a Research Staff Member and a Technical Assistant to Solomon Assefa, VP, IBM Research - Discovery Science and Applications. He has extensive experience in the development of cutting-edge thermal technologies including chip-embedded two-phase cooling, for high performance computing systems and embedded applications such as UAVs (unmanned aerial vehicles), RF (radio frequency), and 5G devices. His expertise includes thermo-fluids engineering, mechanical engineering, numerical methods, numerical computer simulation programs, scripting, signal processing, mathematical algorithms, real-time system control and monitoring and visualization programs. His current research includes aggregation and processing of multi-sensor multi-time scale data to analyze cardiac and mobility behavior, advancement of fundamental understanding of chronic pain in patients with failed back surgery syndrome, characterization of therapeutic effectiveness of implanted spinal cord stimulation waveforms over multiple timescales, development of a system to assist patients in reducing their pain, while also improving their quality-of-life and co-executing clinical studies/sub-studies to evaluate system effectiveness. He obtained his Ph.D. in Mechanical Engineering from Virginia Tech. Dr. Parida has co-authored over 50 peer-reviewed publications, three book chapters, and holds over 90 issued patents.

## PANEL 4: PATFINDING TO MAXIMIZE SYSTEM PERFORMANCE

**WEDNESDAY, OCTOBER 26**

**10:15AM-11:45AM**

**IMPERIAL ROOM, FIRST FLOOR**



**Panel Moderator:**  
**Gamal Refai-Ahmed,** AMD Corp

Dr. Gamal Refai-Ahmed, Life Fellow ASME, Fellow IEEE, Fellow Canadian Academy of Engineering, Professional Engineer Ontario, is AMD Senior Fellow. He obtained the Ph.D. degree from the University of Waterloo. He has been recognized as one of the global technical leaders through his numerous publications (more than 120 publications) and patents and patents pending U.S. (more than 65) and international (more than 110). His contributions are clearly seen in several generations of both GPU, CPU, and FPGA for HPC, AI, ML, NIC, Game Console, Aerospace & Defense, and Telecom products.

In 2015, Gamal was tasked to initiate the heterogeneous integration of system level power, thermal, mech, and assembly with package and Si development in the first initial planning. He has been a key player to introduce all Alveo products and high-end Si CoWos, InFo, Chiplets PKG to AMD customers. He was behind the introduction of the first Lidless FPGA 20, 16, 7nm technology nodes with highest warpage in mass production in Alveo products, and its Telecom, AI, HPC customers (e.g., MSFT, AWS, Nokia, Cisco, and A&D). His developed strategy of technology enables AMD FPGA products to outperform the Intel/Altera Products.

Gamal is the recipient of the 2008 excellent thermal management award, 2010 Calvin Lecture, and 2013 K16-Clock award in recognition for his scientific contributions and leadership of promoting best electronics packaging engineering practice. In 2014, Gamal received the IEEE Canada R. H. Tanner Industry Leadership for sustained leadership in product development and industrial innovation. In 2016, ASME awarded Gamal the ASME Service Award. State University of New York, Binghamton University awarded him the Innovation Partner Award for his industrial role with Binghamton University. In continuation to Dr. Refai contributions to the best engineering practice, the State University of New York at Binghamton awarded him the Presidential University medal in 2019, which is the highest recognition honor by the university. In 2021, Gamal was elected to IEEE Fellow and EIC Fellow.

**Panel Summary:** This panel will address the pathfinding to maximize system performance. In this panel, the challenges that emerge to develop continuous innovations and manufacturable products will be explained. These challenges are utilizing the open-source ecosystem standard. Sticking to a standard that does not evolve rapidly can impact the design freedom; the package architecture, intended application, system level, and manufacturing solution impact on the performance and system IT load balancing.

# Panel Sessions

## Panelists:

**Ivor Barber**, AMD

**Bahgat Sammakia**, Binghamton University

**Ravi Mahajan**, Intel Fellow

**Alfonso Ortega**, Villanova University



**Ivor Barber**,  
AMD

**Abstract :** While monolithic packaging will remain the mainstay of most semiconductor products for years to come, the field of High-Performance Computing is quickly adopting Heterogenous Integration strategies to leverage chiplet configurations. Initial products have been deployed in 2D configurations however continuing miniaturization and performance requirements will help drive 3D technologies, minimizing latency and maximizing IO density.

3D stacking technology will enable Beyond Moore's Law Scaling and enable complex heterogeneous integration schemes with unprecedented IO Density, Functionality and Performance.

Ivor Barber is Corporate Vice President of Packaging at AMD developing advanced package solutions with Chiplet Architecture in High Performance Computing, Graphics and Visualization Technologies. With over 40 years' experience in the field of Semiconductor Packaging, Ivor has held engineering and engineering management positions at National Semiconductor, Fairchild, VLSI Technology, LSI Logic, and Xilinx. He is a frequent panelist and presenter in packaging forums with deep experience in leading edge packaging solutions and high density interconnect technologies. Ivor has 20 published U.S. patents in Semiconductor Package Manufacturing and Package Design and is a board member of MEPTEC. Ivor has a Bachelor of Science Degree in Manufacturing Technology from Napier University, Scotland, UK.



**Bahgat Sammakia**,  
Binghamton University

Dr. Bahgat Sammakia is the Vice President for Research at Binghamton University. He is a Distinguished SUNY Professor and founding Director of the Small Scale Systems Integration and Packaging Center, a NY State Center of Excellence. He has spent much of his research career working to improve thermal management strategies in electronic systems at multiple scales ranging from devices to entire Data Centers. Dr. Sammakia joined the faculty of the Watson School for Engineering and Applied Science in 1998 following a fourteen-year career at IBM where he worked on research and development of organic electronic systems. He has contributed to several books on heat transfer and has over 250 peer reviewed publications related to electronic systems integration and packaging and thermal management of electronic systems. Dr. Sammakia is a Fellow of the IEEE, the ASME, and of the National Academy of Inventors.



**Ravi Mahajan**,  
Intel Fellow

Ravi Mahajan, Intel Fellow, is responsible for Assembly and Packaging Technology Pathfinding. Ravi also represents Intel in academia in research advisory boards, conference leadership, and in various student initiatives. He holds the original patents for silicon bridges, foundational for Intel's EMIB technology. His early insights led to high-performance, cost-effective cooling solutions for high-end microprocessors and the proliferation of photo-mechanics techniques for thermo-mechanical stress model validation. His contributions have earned him numerous industry honors, including SRC's 2015 Mahboob Khan Outstanding Industry Liaison Award, the 2016 THERMI Award from SEMITHERM, the 2016 Allan Kraus Thermal Management Medal and the 2018 InterPACK Achievement award from ASME, the 2019 "Outstanding Service and Leadership to the IEEE" Awards from IEEE Phoenix Section and Region 6, the 2020 Richard Chu ITherm Award, and the 2020 ASME EPPD Excellence in Mechanics Award. He is one of the founding editors for the Intel Assembly and Test Technology Journal (IATTJ) and currently VP of Publications and Managing Editor-in-Chief of the IEEE Transactions of the CPMT. Ravi is a Fellow of two leading societies, ASME and IEEE. He was elected to the National Academy of Engineering in 2022 for contributions to advanced microelectronics packaging architectures and their thermal management.



**Alfonso Ortega**,  
Villanova University

Dr. Alfonso Ortega is the James R. Birlle Professor of Energy Technology at Villanova University and Professor of Mechanical and Sustainable Engineering. He is the Director of the Laboratory for Advanced Thermal and Fluid Systems and the Founding Director of the Villanova site of the NSF Center for Energy Smart Electronic Systems (ES2) founded in 2011. Formerly he was the Associate Dean for Graduate Programs and Research in the College of Engineering and Villanova's inaugural Associate Vice President for Research and Graduate Programs.

Dr. Ortega received his B.S. from The University of Texas-El Paso, and his M.S. and Ph.D. from Stanford University, all in Mechanical Engineering. He was on the faculty of the Department of Aerospace and Mechanical Engineering at The University of Arizona in Tucson for 18 years. For two years, he served as the Program Director for Thermal Transport and Thermal Processing in the Chemical and Transport Systems Division of The National Science Foundation, where he managed the NSF's primary program funding heat transfer and thermal technology research in U.S. universities. Dr. Ortega is a teacher of thermal sciences and experimental methods. He is an internationally recognized expert in thermal and energy management in electronic systems. He has supervised over 40 M.S. and Ph.D. candidates to degree completion, five postdoctoral researchers, and more than 70 undergraduate research students. He is the author of over 300 journal and symposia papers, book chapters, and monographs, and is a frequent short course lecturer and consultant on thermal and energy management and experimental measurements.

## PANEL 3: HYBRID AND SYSTEM LEVEL INTEGRATION FOR ELECTRONICS PACKAGING

WEDNESDAY, OCTOBER 26

8:30AM–10:00AM

IMPERIAL ROOM, FIRST FLOOR



**Panel Moderator:**  
**Pradeep Lall,**  
*Auburn University*

Dr. Pradeep Lall is the MacFarlane Endowed Distinguished Professor with the Department of Mechanical Engineering and Director of the NSF-CAVE3 Electronics Research Center at Auburn University. He holds Joint Courtesy Appointments in the Department of Electrical and Computer Engineering and the Department of Finance. He is a member of the technical council and academic co-lead of automotive and asset monitoring TWGs of NextFlex Manufacturing Institute. He is the author and co-author of two books, 15 book chapters, and over 800 journal and conference papers in the field of electronics reliability, manufacturing, safety, test, energy efficiency, and survivability. Dr. Lall is a Fellow of the ASME, a Fellow of the IEEE, a Fellow of NextFlex Manufacturing Institute, and a Fellow of the Alabama Academy of Science. He is recipient of the IEEE Biedenbach Outstanding Engineering Educator Award, Auburn University Research Advisory Board's Advancement of Research and Scholarship Achievement Award, IEEE Sustained Outstanding Technical Contributions Award, NSF-IUCRC Association's Alex Schwarzkopf Award, Alabama Academy of Science Wright A, Gardner Award, IEEE Exceptional Technical Achievement Award, ASME-EPPD Applied Mechanics Award, SMTA's Member of Technical Distinction Award, Auburn University's Creative Research and Scholarship Award, SEC Faculty Achievement Award, Samuel Ginn College of Engineering Senior Faculty Research Award, Three-Motorola Outstanding Innovation Awards, Five-Motorola Engineering Awards, and over Forty Best-Paper Awards at national and international conferences. Dr. Lall is the founding faculty advisor for the SMTA student chapter at Auburn University and member of the editorial advisory board for SMTA Journal.

**Panel Summary:** Electronics Packaging is an essential part of the manufacturing value chain. Advanced Packaging, PCBs, and Electronics Systems are poised to undergo technology convergence, enabling unique forms of packaging in which components and circuits become increasingly integrated within products. Hybrid, additive processes, combining printing, and discrete components enable layer by layer fabrication with unique opportunities for novel integration. Digital, on-demand workflows have the potential to enable secure manufacturing on smaller footprint factories. This panel discussion will explore the opportunity to combine a broader segment of industrial domains for novel electronics integration: printing to replace discrete components, laser imaging for fine lines, flexible and stretchable materials, techniques borrowed from additive manufacturing and plastics processing, embedded components as well robotic processing on large, conformal surfaces. The combination of these technologies complements existing trends and initiatives for electronics packaging with the potential to impact supply chains.

### Panelists:

**Janos Veres,** *NextFlex*

**Mark Poliks,** *Binghamton University*

**Suresh Sitaraman,** *Georgia Institute of Technology*

**Mary Herndon,** *Raytheon Technologies*



**Janos Veres,**  
*NextFlex*

Dr. Janos Veres is a technologist at heart, and he is passionate about the future of manufacturing and the new ecosystems enabled by digital technologies. Janos has held R&D, manufacturing, and management positions in electronics, displays, specialty materials, and printing companies including PARC, PolyPhotonix, Kodak, Merck, Avecia, Zeneca, and Gestetner, where he developed printed circuits, functional materials, OLEDs, displays, medical devices as well as novel process technologies. He brings experience of industrial partnerships and joint development projects in the U.S., Europe, and Asia. Janos holds a Ph.D. in Solid State Electronics from Imperial College, London. He has authored over 50 patents.

### Presentation Title:

Printed Interconnects on Flexible and Stretchable Surfaces



**Mark D. Poliks,**  
*State University of New York at Binghamton*

**Abstract:** Printing conductive circuits on flexible and stretchable substrates enable electronics that can be applied to a variety of surfaces for use in both medical and industrial applications. These devices may need to conform to surfaces that are not flat, undergo mechanical deformation during use, and exposure to a variety of environmental conditions including extremes in humidity and temperature while maintaining electrical performance. Printed interconnects include conductive circuit traces, filled vias, multi-material interfaces, and interconnects to rigid passive and active components. This presentation will highlight examples of materials, applications, and approaches for electromechanical and environmental tests that help to identify appropriate use conditions.

Mark D. Poliks, Ph.D. is a SUNY Distinguished Professor of Engineering and Empire Innovation Professor in Systems Science and Industrial Engineering and Materials Science and Engineering at the State University of New York at Binghamton. He is the director of the Center for Advanced Microelectronics Manufacturing (CAMM), a New York State Center of Advanced Technology and home to the New York Node of NextFlex. His research is in the areas of industry relevant topics that include high performance electronics packaging, flexible hybrid electronics, medical and industrial sensors, printed RF components, materials, processing, aerosol jet printing, roll-to-roll manufacturing, in-line quality control, and reliability of electronics.

# Panel Sessions



**Suresh K. Sitaraman,**  
*Georgia Institute of Technology*

Dr. Suresh K. Sitaraman is a Regents' Professor and a Morris M. Bryan, Jr. endowed Professor in the George W. Woodruff School of Mechanical Engineering at the Georgia Institute of Technology (Georgia Tech). Dr. Sitaraman is the Lead Faculty for NextFlex at Georgia Tech, and also directs the Computer-Aided Simulation of Packaging Reliability (CASPaR) Lab. His expertise is in the areas of micro- and nano-scale structure fabrication, testing and characterization and physics-based modeling and reliable design, as applied to flexible and rigid microsystems. Prior to joining Georgia Tech in 1995, Dr. Sitaraman was with IBM Corp. Dr. Sitaraman has co-authored more than 330 journal and conference publications over the past few years. He has managed several research and development projects funded by U.S. federal agencies, industry, and other sources totaling millions of dollars, and has mentored a vast array of post-doctoral fellows as well as doctoral, master's, bachelor's, and high-school students.



**Mary Herndon,**  
*Raytheon Technologies*

Dr. Mary K. Herndon is a Senior Engineering Fellow on the Materials Engineering Technical Staff in the Mechanical Engineering Directorate at Raytheon Missiles and Defense (RMD). Mary has a background in semiconductor physics, including processing and characterization of electronic materials. Dr. Herndon joined Raytheon in January 2006 and was named Technology Area Lead for Mechanical, Materials and Structures in June 2014. In this role, she is responsible for technology strategy and development for advanced materials and structures at RMD. Dr. Herndon works closely with universities and technology companies to implement next generation mechanical and materials technologies in Raytheon products. She is co-director of the Raytheon-UMass Lowell Research Institute (RURI), coordinating research on printed electronics and additive manufacturing for RF applications. During her tenure at Raytheon, Dr. Herndon has implemented novel optical techniques for material characterization and served as a Materials Engineering lead for Zumwalt, Patriot and other programs. She has led multiple Advanced Materials and Innovation projects including sensor design for chemical and explosive detection, RF metamaterial research and development of printed electronics materials and processes. Dr. Herndon received her Ph.D. in Applied Physics with an Emphasis in Materials Science from the Colorado School of Mines in December 1999, working within the Center for Solar and Electronic Materials and collaboratively with partners at the National Renewable Energy Lab.

## PANEL 5: THERMAL AND MECHANICAL CHALLENGES AND OPPORTUNITIES OF ADVANCED MOBILE/TELECOM/IOT/AUTO/ COMPUTING DEVICES

WEDNESDAY, OCTOBER 26

2:15PM-3:45PM

IMPERIAL ROOM, FIRST FLOOR



**Panel Moderator:**  
**Victor Chiriac,**  
*Global Cooling Technology Group, LLC*

Dr. Victor Chiriac, Thermal Technologist, Fellow of American Society of Mechanical Engineers, made outstanding industry wide contributions to the cooling of electronic packages and mobile/portable consumer electronic devices. Co-Founder, CEO and Managing Director of Global Cooling Technology Group, LLC. Previously held technology/engineering leadership roles, led corporate thermal technology teams and roadmaps, working on leading-edge mobile/wireless technologies with Motorola (1999-2010), Qualcomm (2010 - 2018) and Futurewei (2018 - 2019). Dr. Chiriac was elected Chair of the ASME K-16 Electronics Cooling Committee in 2015 and was elected the Arizona and New Mexico IMAPS (International Microelectronics and Packaging Society) Chapter President in 2010. He is a co-editor of Electronics Cooling Magazine since 2016 and a leading member of the organizing committees of ASME/InterPack, ASME/IMECE and IEEE/CPMT ITherm Conferences. Has 22 U.S. issued patents, 2 US Trade Secrets, 1 US Defensive Publication and has published over 107 papers in scientific journals and at international conferences. Recipient of the ASME K-16 Clock award in 2018 in recognition of his scientific contributions and leadership in promoting US and worldwide best thermal management of electronics engineering practices. Received Diamond Innovation and Technology Leadership Award at Qualcomm and the Award for Technology at Motorola. PhD (1999) in Aerospace and Mechanical Engineering, University of Arizona, Tucson, USA.

**Panel Summary:** The digital world requires higher performance, more data and faster processors. Heterogeneous Computing involves the central processing units (CPUs), the graphics processing units (GPUs), high speed interconnects and other elements that push forward the computing industry. The emergence of 5G leads to significant rise in mobile communication, IoT technology, providing the infrastructure needed to carry huge amounts of data, allowing for a smarter and more connected world – enabling Smart Cities, connected roads, advanced transportation (Self-driving cars). A Panel of distinguished industry, government and academia members will share their vision on the future of small to large electronics thermal management and other advanced system level thermo-mechanical challenges and solutions of the future.

**Panelists:**

**Sreekant Narumanchi**, *NREL*

**Raffaele Luca Amalfi**, *Seguente LLC*

**Amy Marconnet**, *Purdue University*

**Sam Zhao**, *Broadcom Inc.*

**Christopher Kapusta**, *General Electric Research*

**Kinzy Jones**, *Google Inc.*

**Presentation Title:** Advanced Power Electronics and Electric Machines for Electric-Drive Mobility Applications

**Abstract:** Electronics, power electronics, and electric machines are becoming important for an array of mobility/transportation, renewable energy, and energy efficiency applications. In this presentation, I will provide a brief introduction to NREL and my Group and describe some challenges and opportunities for power electronics, electric machines, and electric drives for mobility applications, in particular. After that, I will give a brief overview of my Group's research activities in these areas with focus on thermal management and reliability aspects.



**Sreekant Narumanchi**,  
*National Renewable Energy Laboratory*

Dr. Sreekant Narumanchi is the Group Manager of the Advanced Power Electronics and Electric Machines (APEEM) Group within the Center of Integrated Mobility Sciences at the National Renewable Energy Laboratory, in Golden, CO, U.S.A., where he is currently in his 18th year. He leads a Group of 15 researchers focused on electro-thermal, thermal-fluids, thermo-mechanical, and reliability aspects of power electronics and electric machines for electric-drive vehicles and several energy efficiency and renewable energy applications. Sreekant is an American Society of Mechanical Engineers (ASME) Fellow, an Institute of Electrical and Electronics Engineers (IEEE) Senior Member, and has published over 90 peer-reviewed journal and conference papers and book chapters. He is an Associate Editor of the ASME Journal of Electronic Packaging, Guest Editor of the IEEE Components, Packaging and Manufacturing Technologies Journal, on the Executive Committee of the ASME Electronic and Photonic Packaging Division, and also serves on several external and advisory boards, and on graduate student thesis committees. Sreekant has received the 2022 THERMI Award, the 2020–2021 Associate Editor of the Year Award from the ASME Journal of Electronic Packaging, the 2018 ASME EPPD-K16 Clock Award, a 2016 R&D 100 Award, the Best Paper Award from the ASME Journal of Electronic Packaging (2003), and the ASME 2013 InterPACK Conference Outstanding Paper Award.

**Presentation Title:** The role of Artificial Intelligence for operating passive thermal management solutions for data centers

**Abstract:** Demanding workloads are driven by applications in mobile broadband, gaming, 5G, Artificial Intelligence and Internet of Things, which requires enhanced thermal performance to manage rising heat dissipation from hardware components. An innovative thermal management strategy is represented by the passive direct-to-chip two-phase technology. In this presentation, I will introduce a machine learning based software for evaluating the thermal performance of SEGUENTE's high-performance rack cooling system.



**Luca Amalfi**,  
*Seguente*

Dr. Amalfi is the CEO and Co-Founder of SEGUENTE, LLC and former Principal Innovator at Nokia Bell Labs US, where he led R&D activities in the field of thermal management of high-performance communications and computing systems. Since 2016, he worked as a Scientific Collaborator and Laboratory Operations Manager at the Swiss Federal Institute of Technology of Lausanne in Switzerland (EPFL). In 2015, he joined Alcatel-Lucent US, where he performed disruptive research on liquid cooling technologies for network equipment. In 2012, he joined IBM Research Lab in Switzerland, where he developed a novel cooling system for high-performance servers. He received a Ph.D. in Energy Engineering from the EPFL and authored over 55 scientific publications in leading journals, conference proceedings, and handbooks. Dr. Amalfi is a Member of the ASME K-16 Heat Transfer Committee, Member of the OCP Heat Reuse Steering Committee, Guest Editor for the ASME Journal of Electronic Packaging, and recipient of numerous IEEE. and ASME Awards.

**Presentation Title:**  
Engineering Passive Two-Phase Thermal Solutions

**Abstract:** In mobile, telecom, IoT, and high-performance computer systems, the heat fluxes are reaching the limits of single-phase cooling solutions. Further, in many applications, the form factor and use conditions prohibit active cooling strategies such as pumped liquids. Here, I will briefly introduce my group's work on passive two-phase thermal solutions including solid-liquid phase change material-based heat sinks and boiling in confined geometries.



**Amy Marconnet**,  
*Purdue University*

Dr. Amy Marconnet is an associate professor of Mechanical Engineering and a Perry Academic Excellence Scholar at Purdue University. She received a B.S. in Mechanical Engineering from the University of Wisconsin – Madison in 2007, and an M.S. and a Ph.D. in Mechanical Engineering at Stanford University in 2009 and 2012, respectively. Her

# Panel Sessions

dissertation focused on thermal phenomena in nanostructured materials. She then worked briefly as a postdoctoral associate at the Massachusetts Institute of Technology, before joining the faculty at Purdue University in August 2013. She was promoted to associate professor with tenure in August 2019.

**Presentation Title:** IC Device Air Cooling and 3DIC Thermal Challenges

**Abstract:** Air cooling has been the only thermal management method for IC devices, and our current IC industry thermal standards, chip thermal resistance Theta-JA for example, are defined based on air cooling. Driven by the performance demand from HPC applications such as AI/ML and cloud computing as well as AI/ML network switching, device power dissipation is approaching 1000W. Air may become the limiting factor to Moore's law in terms of doubling chip performance every 18~24 months. This panel will discuss challenges and opportunities in expanding the boundary of air-cooling technology as well as emerging new architectural solutions. We will also discuss 3DIC/chiplets thermal challenges and opportunity for innovations.



**Sam Zhao,**  
*Broadcom*

Dr. Sam Zhao received his Bachelor's and Master's degrees from Tsinghua University, Beijing, China, and his Ph.D. degree from the University of Illinois, Chicago. He is a Broadcom Distinguished Engineer specializing in the areas of 3D IC packaging, flip chip technologies, and thermal solutions. Sam currently holds 122 U.S. issued patents and has 40 journal and conference publications.

**Presentation Title:** Considerations and Challenges for Industrial Electronics

**Abstract:** Large industrial systems are getting more complex and "Smarter" with adoption of 5G and IoT. This talk will cover the challenges with developing microsystem technologies in "low" volume, harsh environments and high reliability application space, covering Aviation, Medical, and Power Markets.



**Christopher J. Kapusta,**  
*GE Global Research Center*

Christopher J. Kapusta is a Principal Engineer at GE Global Research Center's Microelectronics Laboratory focused on the fabrication processes and system integration of next generation electronic packages and interconnect technologies. He earned his Bachelor of Science Degree in Chemistry at the State University of New York Oswego in 1996. Since joining GE Global Research in 1999, he contributed to many programs

involving the integration of advanced semiconductors in Power Overlay (POL) Multi-Chip Modules, 3-D and Ultra-Thin die stacking, and Photonic Integration. He has led programs for MEMS integration and Wafer-level Packaging for GE businesses. The past several years of his research has been focused on the Tech Transfer of the POL-kW process to GE Businesses and Strategic Partners for SiC power modules. He has over 50 U.S. patents, is the author of 50+ publications, and also holds a 6sigma Greenbelt/DFSS Certification.

**Presentation Title:** Utilizing Multiphysics Analysis to Solve Immersive Computing Challenges

**Abstract:** Immersive and wearable computing present a new set of challenges to productize a solution at scale. The tight coupling of mass, volume, power, thermals, and cost must be carefully considered. This talk will highlight a couple of workstreams with the hope of illustrating the importance of understanding this in the context of augmented reality hardware development.



**Kinzy Jones,**  
*Google Inc.*

Dr. Kinzy Jones background is in mathematical modeling including materials, fluids, and structures. His work strives to use simulation, material analysis, and high-fidelity testing to predict product failures and identify design improvements, thus reducing cost from unnecessary prototype builds and field failures, reducing time to market, and improving KPIs. He is a Distinguished Engineer in Google Lab's AR/VR group serving as the lead for a newly developed team in simulation science. Previously, at Magic Leap he managed the Advanced Mechanics and Materials group and served as a Magic Leap Fellow. He received his Ph.D. from University of California, Berkeley in Materials Science and Engineering

## PANEL 6: SUSTAINABLE ENERGY SYSTEMS IN ICT

WEDNESDAY, OCTOBER 26

4:00PM–5:30PM

IMPERIAL, FIRST FLOOR

### Panel Moderator(s):

Raffaele Luca Amalfi, *Seguente*



**Luca Amalfi,**  
*Seguente*

Dr. Luca Amalfi is the CEO and Co-Founder of Seguente, LLC and former Principal Innovator at Nokia Bell Labs US, where he led R&D activities in the field of thermal management of high-performance communications and computing systems. Since 2016, he worked as a Scientific Collaborator and Laboratory Operations Manager at the Swiss Federal Institute of Technology of Lausanne in Switzerland (EPFL). In 2015, he joined Alcatel-Lucent US, where he performed disruptive research on liquid cooling technologies for network equipment. In 2012, he joined IBM Research Lab in Switzerland, where he developed a novel cooling system for high-performance servers. He received a Ph.D. in Energy Engineering from the EPFL and authored over 55 scientific publications in leading journals, conference proceedings, and handbooks. Dr. Amalfi is a Member of the ASME K-16 Heat Transfer Committee, Member of the OCP Heat Reuse Steering Committee, Guest Editor for the ASME Journal of Electronic Packaging, and recipient of numerous IEEE and ASME Awards.

**Panel Summary:** Information and communications technologies (ICT) are increasingly permeating our daily life, fueled by digital transformation and cloud computing. Events like the COVID-19 pandemic generated an exceptional burden upon all market segments. The increase of energy use in conjunction with the significant climate change had put sustainability at the top-of-mind issue, becoming the main performance metric for deploying new products and services. To avoid irreversible economic and environmental consequences, countries have introduced carbon credit to incentivize enterprises to reduce energy use, as well as reduce and/or capture carbon emissions. A panel of experts from industry and academia will discuss the importance of sustainable energy systems and provide guidelines to achieve a greener ICT.

### Panelists:

**Filippo Cataldo,** *Wieland Provides*

**Aaron Wemhoff,** *Villanova University*

**Solomon Adera,** *University of Michigan*

**Ryan Enright,** *Seguente LLC*

**Cosimo Pecchioli,** *Alfa Laval*

**Presentation Title:** Exergy Analysis of Computing Systems: A Driver For Sustainability



**Filippo Cataldo,**  
*University of Naples Federico II*

**Abstract:** Exergy is potential for use, a potential that is almost always wasted in modern computing systems. Identifying where the exergy is destroyed should be the driver to make information technology more sustainable, at least from an energy-use standpoint. The objective of the presentation is to discuss wasted opportunities in computing systems in general and data centers in particular, and how to reduce them via new thermal technologies.

Dr. Filippo Cataldo received his master's degree and Ph.D. in Mechanical Engineering at University of Naples Federico II. Later he joined the Laboratory of Heat and Mass Transfer (LTCM) at EPFL. His works and studies converged toward Energy Conversion and Thermal Management, with specialization in two-phase flow heat transfer and heat pipes. After more than six years of academic experience, he joined Provides Metalmeccanica (Italy) as Principal Scientist in 2018, developing two-phase flow-based technology for electronics cooling. He is author and co-author of more than 20 journal and conference papers.

**Presentation Title:** Data Center Water Stress Impact Characterization



**Aaron Wemhoff,**  
*Villanova University*

**Abstract:** The public has increasingly been paying attention to data center water consumption. As a result, water usage effectiveness (WUE) is becoming increasingly emphasized as an environmental metric in the data center community. However, water usage should be considered relative to available water both at the data center site and at power generation sources, captured as a regional water scarcity footprint that characterizes water stress. This presentation discusses a proposed new metric, water scarcity usage effectiveness (WSUE), which could be used to aid data center owners in siting new data center locations and designing cooling systems to mitigate the water stress impact by the industry.

Dr. Aaron Wemhoff is currently an associate professor in the Department of Mechanical Engineering at Villanova University. He started at Villanova

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in 2008 after a 3.5-year stint as a staff engineer at LLNL. He graduated with a Ph.D. from UC Berkeley in 2004. He is an ASME Fellow and currently serves as an associate editor for the ASME Journal of Thermal Science and Engineering Applications.

**Presentation Title:** Improving Condensation Heat Transfer Rate



**Solomon Adera,**  
*University of Michigan*

**Abstract:** Nearly 90% of the global electricity is generated through the steam cycle, which uses primarily non-renewable energy sources (for example, coal). Furthermore, power plants have notoriously low thermodynamic efficiency. Given the large scale and low efficiency of steam cycles, marginal improvements in the overall heat transfer rate during condensation can have substantial impacts in the amount of CO<sub>2</sub> released into the environment. In our lab, we use micro/nanoengineered surfaces to improve the overall efficiency of the steam cycle in power plants.

Dr. Solomon Adera earned his Ph.D. in Mechanical Engineering from MIT in 2016. He was a Postdoctoral Associate in the School of Engineering and Applied Sciences at Harvard University from 2017 to 2019. Currently, he is an Assistant Professor in Mechanical Engineering at the University of Michigan. His research interests include surface wettability, droplets and bubbles, micro/nano-structuring, fluid mechanics, thermal management, phase change heat transfer, such as evaporation, condensation, and freezing.

**Presentation Title:** The Edge Data-Energy-Water Nexus



**Ryan Enright,**  
*Seguente*

**Abstract:** The end of Moore's law and ongoing digitization of human activities is accelerating compute energy demands. Edge deployment of computational resources adds further challenge to meeting energy and water demands in urban centers. A system-level circular-economy concept is introduced to address energy and water concerns by integrating data center heat reuse, methanol reforming fuel cells and organic Rankine cycles. This approach has the potential to transform urban edge data centers from energy and water consumers to net energy and clean water producers in a global green methanol economy.

Dr. Ryan Enright is the Chief Technology Officer of Seguente LLC since April of this year. Prior to taking on this role, he was a Senior Member of Technical Staff at Nokia Bell Labs for nine years in the Efficient Energy Transfer Department, where his research spanned the areas of materials interface engineering, micro/nanoscale heat/mass transfer, passive heat transfer mechanisms and integrated RF, and photonic and electronic thermal management. He received his B.Eng. and Ph.D. degrees in Mechanical Engineering from the University of Limerick, Ireland. He was a Research Assistant at Bell Labs (USA) during his doctoral work. After receiving his Ph.D., he was a SFI CTVR postdoctoral associate from 2008 to 2009 and a Marie-Curie postdoctoral fellow at the MIT. Ryan has (co-) authored over 100 journal and conference publications and has filed more than 20 patent applications.

**Presentation Title:** Data Centers Heat Reuse



**Cosmo Pecchioli,**  
*Alfa Laval*

**Abstract:** Heat reuse in data centers is an ideal opportunity to increase sustainability, become carbon and water positive, and in general, make a positive impact on society and communities. However, there are three levels of challenges to be considered, including: (i) technical aspects in how to capture, handle, deliver and measure the heat; (ii) regulatory aspects linked to financial incentives and (iii) practical aspects linked to stakeholders and their business goals. In this presentation, I will also share high-level guidelines of the OCP heat reuse work group that facilitates discussions on how define those challenges and promote collaborations to discover the best possible solutions.

Cosimo Pecchioli has been working for Alfa Laval for 18 years covering different roles. Originally from Italy, he has been living in California for over 15 years. He holds a master's degree in science and technology. For the last five years he has coordinated the Data Center Heat Management team in the U.S. He is also a member of the OCP for two years, since January 2022, and has been co-chairing the heat reuse incubation group.



## PANEL 7: RELIABILITY OF ADDITIVELY MANUFACTURED ELECTRONICS

THURSDAY, OCTOBER 27

8:30AM–10:00AM

IMPERIAL ROOM, FIRST FLOOR



**Panel Moderator:**  
**Patrick McCluskey,**  
*University of Maryland*

Dr. Patrick McCluskey is a Professor of Mechanical Engineering at the University of Maryland, College Park, and the Department's Director of Undergraduate Studies. He has over 25 years of research experience in the areas of thermal management, reliability, and packaging of electronic systems for use in extreme temperature environments and power applications. Dr. McCluskey has co-authored three books, five U.S. Patents, and over 200 peer-reviewed technical articles with nearly 4000 citations. He is an associate editor of the IEEE Transactions on Components, Packaging, and Manufacturing Technology, a member of the board of governors of the IEEE Electronic Packaging Society, a fellow and member of the Executive Council of IMAPS, and a member of ASME.

**Panel Summary:** Additive manufacturing covers a wide variety of processes, ranging from stereolithography and fused deposition modeling of polymers to direct laser metal sintering of metals. As additive manufacturing has matured from a prototyping technique to one that is creating actual parts for use, the need for assessing the reliability of parts created by these processes has grown. Each of these processes, however, is unique in the defects they create, the dimensions they can produce, and the failure mechanisms to which they are susceptible. Some of the key issues in common are the high level of porosity, high surface area to volume ratio, and significant surface roughness of the prints. In addition, most prints have artificial horizontal grain boundaries which can affect knit strength across the layers and interfacial adhesion. Finally, because of the way the parts are produced, there are high levels of residual stresses. This panel will discuss these issues, how to model them, and their effect on reliability. The panel will then propose ways to produce more robust products using additive manufacturing.

### Panelists:

**David Huitink,** *University of Arkansas*  
**Abhijit Dasgupta,** *University of Maryland*  
**David Shaddock,** *GE*  
**Mark Poliks,** *Binghamton University*  
**Pradeep Lall,** *Auburn University*

**Presentation Title:** Arithmetic Manufacturing: Exploring Additive + Subtractive Manufacturing Methods for Electronics Packaging

### Abstract:



**David Huitink,**  
*University of Arkansas*

**Abstract:** As additive manufacturing technology has opened new pathways for 3D design, electronics packaging has been relatively slow in adopting AM, as the component scales and materials are limited for interfacing with electrical functional requirements. Conductive inks have primarily been explored, but these materials tend to exhibit undesirable resistivity, and interconnect dimensions are not yet competitive with traditional interconnect technologies. This talk will examine the use of non-conventional AM approaches in creating structures for achieving preferable material properties, such as electrical conductance, or temperature stable materials formation in the context of electronic packaging.

Professor David Huitink joined the faculty in Mechanical Engineering at the University of Arkansas in 2016, prior to which he spent more than five years in industry, working in microelectronics technology development and manufacturing at Intel Corporation, where he served as Quality & Reliability Engineering Program Manager for Intel's Custom Foundry Division. There he pioneered the development of advanced methods of predicting reliability of silicon-based flip chip microelectronic packages, as well as developed testing protocols and FEA methods for governing Design for Reliability (DfR) guidance. In academia, Dr. Huitink has built a research program at the intersection of thermal and materials sciences, with primary application in creating solutions for enabling high power dense and reliable electronics. This includes novel material and manufacturing approaches to thermal management of power electronics in electric aircraft and automobiles, as well as development of materials and process methodologies for multifunctional packaging architectures for heat dissipation and structural stability in extending device lifetimes. Working closely with Electrical Engineering collaborators, his team has developed additive manufactured cooling technologies that incorporate

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design features for passive thermal management with nano-enhanced phase change materials, in addition to EMI shielding jet manifolds for high convective heat transfer. On a more fundamental research level, he also investigates nanoscale thermal transport phenomena from inductively heated nanoparticles, for enabling new heat delivery mechanisms through alternating electromagnetic fields. Prior to his industry experience, Dr. Huitink received his Ph.D. in Mechanical Engineering from Texas A&M University as a NSF Graduate Research Fellow, working on complex nano-scale interactions at material interfaces under chemical and mechanical influence.

### Presentation Title:

Structure, Processing, Properties Relationships in Additively Printed Electronics

Aerosol jet printing and syringe printing processes are often used for additive fabrication of electronic structures and interconnects. The geometry of the substrate and interconnects, the material choice for inks and dielectrics, and the printing settings are all crucial for producing robust and reliable printed patterns that also have acceptable electrical and thermal properties. The underlying fundamental process physics is important for producing printed structures with high quality. The underlying degradation physics is similarly critical for producing robust and reliable printed structures. The lessons being learned at the CALCE Center on fundamental and quantitative understanding of this interplay between process and reliability physics principles will be presented at this panel.



**Abhijit Dasgupta,**  
*University of Maryland*

Abhijit Dasgupta is Jeong H. Kim Professor of Mechanical Engineering at the University of Maryland (UMD), with research experience in the microscale and nanoscale mechanics and reliability physics of engineered materials. Typical applications are in heterogeneous integration of microelectronics, in additively manufactured electronic systems and in intelligent microsystems.

He holds a Ph.D. in Theoretical and Applied Mechanics from the University of Illinois at Urbana-Champaign (UIUC), and has been a principal investigator at the Center for Advanced Life Cycle Engineering (CALCE) at UMD for over 34 years, conducting research in reliability physics, design for reliability, accelerated stress testing, and real-time health management.

He has published over 300 articles and conference papers; served on

editorial boards of three international archival journals; presented over 50 workshops and short courses; helped form research and educational roadmaps for the electronics industry, and provided consulting services to numerous industry leaders. He has presented numerous keynote talks at international conferences, received 6 best-paper awards and received 8 major awards in recognition of his research and educational contributions.

He has found it very rewarding to have worked with many memorable graduate students over the years, many of whom have gone on to highly prestigious positions in industrial, academic and government positions all over the world and become highly recognized experts in their own rights.

He is an ASME Fellow, past Chair of the ASME Electronic and Photonic Packaging Division (EPPD) and Current Chair of Reliability Technology Working Group in the Heterogeneous Integration Roadmap (HIR) Team sponsored by IEEE / ASME / SEMI / IEPS / EDS. He has held various leadership roles in ASME InterPACK, IEEE ITherm, IEEE Eurosime and IEEE REPP Conferences

### Presentation Title:

Additive Manufacturing for Harsh Environment Electronics



**David Shaddock,**  
*GE*

David Shaddock (Member, IEEE) received the B.S. degree in mechanical engineering from Carnegie Mellon University, Pittsburgh, PA, USA, in 1982, and the M.S. degree in electronics manufacturing from Rensselaer Polytechnic Institute, Troy, NY, USA, in 2005. He has been a Senior Engineer at General Electric Research, Niskayuna, NY, USA, since 1995. Prior to that, he held leadership and process engineering positions to developed processes for electronics assembly and component manufacturing at Rockwell Network Transmission Systems, Dallas, TX, USA (1985–1991), Rockwell Telecommunications, El Paso, TX, USA (1991–1995), and Motorola Inc. Components, Franklin Park, IL, USA (1982–1984), Motorola Inc. Cellular Systems, Schaumburg, IL, USA (1984–1985). He has more than 52 publications and holds 24 patents. His research interests include electronics manufacturing and reliability with a current focus on high-temperature electronics packaging, processes, and materials. Mr. Shaddock was a Nominated Rockwell Engineer of the Year in 1989 for the development of robotic assembly equipment. He received the GE Global Research Technology Award in 2018. He was a member (1999–2002) and the Chairperson (2002–2004) of the Board of Advisors Association of Electronic Manufacturing of the Society of Manufacturing Engineers.



**Mark Poliks,**  
*Binghamton University*

Dr. Mark D. Poliks is Empire Innovation Professor of Engineering, Professor of Systems Science and Industrial Engineering, Professor of Materials Science and Engineering and Director of the Center for Advanced Microelectronics Manufacturing (CAMM), A New York State Center of Advanced Technology at the State University of New York at Binghamton. In 2006 he established the first research center (CAMM), to explore the application of roll-to-roll processing methods, including large-area photolithography, to flexible electronics and displays, with equipment funding from the United States Display Consortium (USDC) and the Army Research Lab.

His research is in the areas of industry relevant topics that include high performance electronics packaging, flexible hybrid electronics, medical and industrial sensors, materials, processing, aerosol jet printing, roll-to-roll manufacturing, in-line quality control, and reliability. He has received more than \$20M in research funding from Federal, New York State, and corporate sources and more than \$30M in equipment funding from federal and state sources. He is the recipient of the SUNY Chancellor's Award for Excellence in Research. He leads the New York State Node of the DoD NextFlex Manufacturing USA and was named a 2017 NextFlex Fellow. He has authored more than one-hundred technical papers and holds forty-eight U.S. patents. Previously he held senior technical management positions at IBM Microelectronics and Endicott Interconnect.

Dr. Poliks is a member of technical councils for the FlexTech Alliance, NBMC, and NextFlex, and on the NextFlex Governing Council. He is an active member of the IEEE Electronics Packaging Society Electronic Component and Technology Conference and served as the 69th ECTC General Chair. Poliks received dual undergraduate degrees, with honors, in chemistry and mathematics from the University of Massachusetts and a Ph.D. from the University of Connecticut in materials science and engineering. He was a McDonnell-Douglas post-doctoral fellow working on solid-state magnetic resonance at Washington University, St. Louis before starting his career at IBM.

**Presentation Title:**

Process Reliability Interactions for Additive Printed Electronics

**Abstract:**



**Pradeep Lall,**  
*Auburn University*

Dr. Pradeep Lall is the MacFarlane Endowed Distinguished Professor with the Department of Mechanical Engineering and Director of the NSF-CAVE3 Electronics Research Center at Auburn University. He holds Joint Courtesy Appointments in the Department of Electrical and Computer Engineering and the Department of Finance. He is a member of the technical council and academic co-lead of automotive and asset monitoring TWGs of NextFlex Manufacturing Institute. He is the author and co-author of two books, 15 book chapters, and over 800 journal and conference papers in the field of electronics reliability, manufacturing, safety, test, energy efficiency, and survivability. Dr. Lall is a Fellow of the ASME, a Fellow of the IEEE, a Fellow of NextFlex Manufacturing Institute, and a Fellow of the Alabama Academy of Science. He is recipient of the IEEE Biedenbach Outstanding Engineering Educator Award, Auburn University Research Advisory Board's Advancement of Research and Scholarship Achievement Award, IEEE Sustained Outstanding Technical Contributions Award, NSF-IUCRC Association's Alex Schwarzkopf Award, Alabama Academy of Science Wright A, Gardner Award, IEEE Exceptional Technical Achievement Award, ASME-EPPD Applied Mechanics Award, SMTA's Member of Technical Distinction Award, Auburn University's Creative Research and Scholarship Award, SEC Faculty Achievement Award, Samuel Ginn College of Engineering Senior Faculty Research Award, Three-Motorola Outstanding Innovation Awards, Five-Motorola Engineering Awards, and over Forty Best-Paper Awards at national and international conferences. Dr. Lall is the founding faculty advisor for the SMTA student chapter at Auburn University and member of the editorial advisory board for SMTA Journal.

## PANEL 8: HETEROGENEOUS INTEGRATION

TUESDAY, OCTOBER 25

4:00PM–5:30PM

ROYAL E & F, FIRST FLOOR

(Need Presentation Titles and Abstracts for all the Panelists)



**Panel Moderator:**

**Ravi Mahajan,**

*Intel Corp.*

Dr. Ravi Mahajan, Intel Fellow, is responsible for Assembly and Packaging Technology Pathfinding. Ravi also represents Intel in academia in research advisory boards, conference leadership, and in various student initiatives. He holds the original patents for silicon bridges, foundational for Intel's EMIB technology. His early insights led to high-performance, cost-effective cooling solutions for high-end microprocessors and the proliferation of photo-mechanics techniques for thermo-mechanical stress model validation. His contributions have earned him numerous industry honors, including SRC's 2015 Mahboob Khan Outstanding Industry Liaison Award, the 2016 THERMI Award from SEMITHERM, the 2016 Allan Kraus Thermal Management Medal and the 2018 InterPACK Achievement award from ASME, the 2019 "Outstanding Service and Leadership to the IEEE" Awards from IEEE Phoenix Section and Region 6, the 2020 Richard Chu ITherm Award and the 2020 ASME EPPD Excellence in Mechanics Award. He is one of the founding editors for the Intel Assembly and Test Technology Journal (IATTJ) and currently VP of Publications and Managing Editor-in-Chief of the IEEE Transactions of the CPMT. Ravi is a Fellow of two leading societies, ASME and IEEE. He was elected to the National Academy of Engineering in 2022 for contributions to advanced microelectronics packaging architectures and their thermal management.

**Panel Summary:** In this panel we will discuss various Roadmapping efforts for HI in progress and how they can be made complementary to strengthen and unify direction in the industry.

### Panelists:

**Todd Younkin, SRC**

**Francis (Frank) Mullany, iNEMI**

**Bill Bottoms, HIR**

**Subu Iyer, UCLA**



**Todd Younkin,**

*SRC*

In August of 2020, Dr. Todd Younkin became the CEO of SRC, where he leads a ~\$90M/yr. global research agenda supported by ~3k academic and industrial researchers, 26 international companies, and 3 U.S. government agencies. Shortly thereafter, SRC released its 2030 Decadal

Plan for Semiconductors, where it identified the five "seismic shifts" shaping the future of information and communication technologies (ICT). Working closely with SIA, SRC has called for greatly increased federal investments throughout the decade to establish a smarter pipeline for semiconductor R&D, aligned to SRC's Decadal Plan. Prior to becoming SRC's CEO, Dr. Younkin's research and development experience spanned Intel's 0.18um to 5nm nodes with technical contributions in novel materials, nanotechnology, integration, advanced lithography, and integrated photonics.

From 2010 to 2013, Dr. Younkin was on assignment to IMEC's advanced lithography program to mature both EUV lithography (EUVL) and the Directed Self-Assembly (DSA) of block copolymers (BCPs) and return the technology to Intel in Portland, OR. In 2018, Dr. Younkin engineered, launched, and led all programmatic aspects of the 5-year, \$250 million JUMP research initiative, led by the Semiconductor Research Corporation (SRC) in collaboration with DARPA and their Electronics Resurgence Initiative (ERI). JUMP has 6 multi-university, multi-disciplinary innovation centers that bring together 140 faculty, 701 students, and 387 industrial engineering liaisons on 172 research tasks at 32 universities. It emphasizes the advancement of Materials, Electrical Engineering, and Computer Engineering to secure continued U.S. thought leadership in semiconductors.

Dr. Younkin holds a Ph.D. from the California Institute of Technology in Pasadena, California. He completed his Bachelor of Science at the University of Florida in Gainesville, Florida.



**Francis (Frank) Mullany,**

*iNEMI*

Dr. Francis (Frank) Mullany came to iNEMI from a long career at Nokia Bell Labs, where he was most recently a research strategist in Bell Labs Research, working with lead researchers to define roadmaps, research strategy, and technology marketing. His 20 years of managerial and technical experience spans a broad range of wireless and networking technologies, from RF hardware to network slicing, and from real-time machine-learning inference engines to end-to-end orchestration. Frank joined Bell Labs in 1998, first with the Wireless Research Laboratory in the UK and then he helped establish Bell Labs Ireland in Dublin in 2004. He built up and led the RF Antennas and Front-End Technologies department focusing on novel RF technologies and hardware. In 2013, Frank established Bell Labs' Internet of Things research program before moving to the CTO organization to lead the Network Compliance, Reliability, Security and Corporate Standards organization. In 2015, he returned to Bell Labs Research to take up a research strategy role. Frank was Alcatel-Lucent's representative on EPoSS, the European smart system

industry association, and was the editor for the telecommunications section of the EPOSS Strategic Research Agenda. He received B.E. and Ph.D. degrees in Electronic Engineering from University College Dublin, National University of Ireland.



**Subu Iyer,**  
UCLA

Subramanian S. Iyer (Subu) is Distinguished Professor and holds the Charles P. Reames Endowed Chair in the Electrical Engineering Department and a joint appointment in the Materials Science and Engineering Department at the University of California at Los Angeles. He is Director of the Center for Heterogeneous Integration and Performance Scaling (UCLA CHIPS). Prior to that he was an IBM Fellow. His key technical contributions have been the development of the world's first SiGe base HBT, Salicide, electrical fuses, embedded DRAM, and 45nm technology node used to make the first generation of truly low power portable devices as well as the first commercial interposer and 3D integrated products. He also was among the first to commercialize bonded SOI for CMOS applications through a start-up called SiBond LLC. More recently, he has been exploring new packaging paradigms and device innovations that may enable wafer-scale architectures, in-memory analog compute and medical engineering applications. He has published over 300 papers and holds over 75 patents. He has received several outstanding technical achievements and corporate awards at IBM. He is an IEEE Fellow, an APS Fellow, an iMAPS Fellow and a Distinguished Lecturer of the IEEE EDS and EPS, and a member of the Board of Governors of IEEE EPS. He is also a Fellow of the National Academy of Inventors. He is a Distinguished Alumnus of IIT Bombay and received the IEEE Daniel Noble Medal for emerging technologies in 2012, the 2020 iMAPS Daniel C. Hughes Jr. Memorial award, and the iMAPS distinguished educator award in 2021.

List of publications/patents: <https://scholar.google.com/citations?user=xXV4oIMAAA&hl=en>



**Bill Bottoms,**  
HIR

Dr. Bill Bottoms received a B.S. degree in Physics from Huntington College in Montgomery, Alabama in 1965, a Ph.D. in Solid State from Tulane University in New Orleans in 1969, and is currently Chairman of Third Millennium Test Solutions. He has worked as a faculty member in the department of electrical engineering at Princeton University, manager of Research and Development at Varian Associates, founding President of the Semiconductor Equipment Group of Varian Associates, and general Partner of Patricof & Co. Ventures. Dr. Bottoms has participated in the startup and growth of many companies through his venture capital activity and through his own work as an entrepreneur. He has served as Chairman and CEO of many companies both public. Some of his current responsibilities include: Emeritus Member of the Board of Tulane

University, Co-Chair of the Heterogeneous Integration Roadmap, Chairman of the SEMI's Awards Committee, Member of the Board of MIT's Microphoton Center, Chairman of Fluence Analytics, Chairman of the Technology Board of Tulane's POLYRMC center, and Chairman of Third Millennium Test Solutions.

## PANEL 9: WHY AI/DATA SCIENCE PROJECTS FAIL

**THURSDAY, OCTOBER 27**

**10:15AM-10:45AM**

**SEVILLE ROOM, SECOND FLOOR**



**Panel Moderator:**  
**Azeem Sarwar,**  
General Motors

Dr. Azeem Sarwar is working as a Lab Group Manager at General Motors (GM) Research and Development Center where his group focuses on virtualization, system safety standards, computation, and software V&V. His group is also contributing towards the development of Lunar Mobility Vehicle. At GM, he has contributed towards more than 40 records of invention and has twice received the "Boss" Kettering Award—GM's highest innovation award granted for making significant business impact. He is also a recipient of the IEEE PHM Conference Best Paper Award. His work has been featured in one book chapter, three invited journal publications, and more than 30 peer reviewed articles. Azeem received a Bachelor's Degree in Mechanical Engineering with highest honors from National University of Sciences and Technology, Pakistan. He received a Master's Degree in Mechanical Engineering, a Master's Degree in Mathematics, and a Ph.D. in Mechanical Engineering from the University of Illinois at Urbana-Champaign. He is an avid runner and spends free time mentoring and coaching graduate and undergraduate students.

**Panel Summary:** In this panel we will explore and discuss the most common reasons that prevent 87% of AI or Big Data projects from getting deployed into production. Drawing from the experience and expertise of our panelists, we will also discuss strategies that can allow the AI or Data Science practitioners to have a higher success rate towards productionizing their projects. Specifically, the role of working on the right project, asking the right questions, alignment with the stakeholders, identifying metrics for success, and simplicity of solution and explainability will be explored and discussed.

# Panel Sessions

## Panelists:

Joyce Weiner, *Intel*

Taimoor Khawaja, *Cox Communications*

Syed Usman Ali, *Bloomberg*

Krishna Gede, *Fiddler AI*



**Joyce Weiner,**  
*Intel*

Joyce Weiner is a Principal Engineer, AI Software Architecture at Intel Corporation. As a Lean expert and Data Scientist, she focuses on using data to drive change and improve efficiency. Joyce is currently working on projects to use AI to assist system designers, and to unlock insights from text fields. Her book, *Why AI/Data Science Projects Fail: How to Avoid Project Pitfalls*, was published in 2021. Joyce has a BS in Physics from Rensselaer Polytechnic Institute and an MS in Optical Sciences from the University of Arizona. She is married and in her free time enjoys drawing, calligraphy, and reading.



**Taimoor Khawaja,**  
*Cox Communications*

Dr. Taimoor Khawaja is a technology veteran with two decades of invaluable industry experience in consumer intelligence, operations, and business optimization. He currently leads the core Machine Learning portfolio at Cox Communications where his teams are evangelizing an ML-first approach to customer experience, network optimization, and asset management. Prior to joining Cox, he held leadership roles in Nike, Foot Locker, and GE. Taimoor holds a Ph.D. degree in Electrical and Computer Engineering from Georgia Institute of Technology. Like all engineers, he enjoys posing inverse questions that challenge the status quo.



**Syed Usman Ali,**  
*Bloomberg*

Usman Ali Syed is a Lead Software Engineer at Bloomberg LP. As a tech lead, his current role involves designing and implementing architectures to curate, onboard, and integrate ESG data. His current projects align with his passion to bring big data to life and enable seamless integration from multiple sources. In his previous roles, Usman has worked on AI/NLP models to build recommendation systems along with creating customizable user dashboard pills for increased productivity. He has an MS from the University of Illinois at Urbana-Champaign in ECE. He is an avid cricket fan and loves classical music.



**Krishna Gede,**  
*Fiddler AI*

For most of the last two decades, Krishna Gade spent time building scalable platforms at internet companies like Bing, Twitter, Pinterest, and Facebook to convert data into intelligent insights using big data, machine learning, and deep learning technologies. At Facebook, Krishna was leading the News Feed Ranking Platform that created the infrastructure for ranking content in News Feed and powered use-cases like Facebook Stories and recommendations like People You May Know, Groups You Should Join, etc. My team built Facebook's explainability features like 'Why am I seeing this?' which helped bring much-needed algorithmic transparency and thereby accountability to the News Feed for both internal and external users.

**TUESDAY, OCTOBER 25**

**7:30AM-8:30AM**

**ROYAL A & B, FIRST FLOOR**

**Abstract:** To perform increasingly diverse missions in increasingly crowded EM environments, future sensor and communication systems will require increased bandwidth and sensitivity and enhanced functionality per unit area. These needs are driving sensor arrays towards higher levels of integration of a diverse set of materials, devices, and components across multiple domains. This includes 3D solutions, particularly at millimeter wave and THz frequencies. This talk will present an overview of the evolution of heterogeneous integration programs at DARPA and potential paths forward, including 3DHI at the transistor level being explored under the DARPA Heterogeneous Heterostructures (H2) and related programs.

**Presentation Title:**

Heterogeneous Integration (HI): An Enabler for Next Generation Systems



**Thomas E. Kazior,**  
DARPA

Dr. Thomas E. Kazior joined DARPA in July 2020 as a program manager in the Microsystems Technology Office (MTO). His research interests include semiconductor material and device design, fabrication and integration processes including 3D heterogeneous integration (HI) of silicon and compound semiconductor and other non-silicon devices for RF arrays, and microwave/millimeter-wave/sub-millimeter-wave devices for sensors and communications.

Kazior received his Doctor of Philosophy degree in material science and engineering, specializing in electronic materials, from the Massachusetts Institute of Technology. Prior to joining DARPA, he was a senior principal fellow at Raytheon Company's Integrated Defense Systems. Kazior has co-authored more than 100 publications, contributed and invited conference papers, and a book chapter on compound semiconductor and heterogeneous integration technology. He also has more than 20 patents in semiconductor fabrication technology. Kazior participated in the International Technology Roadmap for Semiconductors (ITRS), co-authoring the analog mixed signal chapter. He is an IEEE fellow.

**TUESDAY, OCTOBER 25**

**1:15PM-2:15PM**

**ROYAL A & B, FIRST FLOOR**

**Presentation Title:**

Integration Strategies in the Chiplet Era

**Abstract:**

TBD



**Ivor Barber,**  
AMD

Ivor Barber is Corporate Vice President of Packaging at AMD developing advanced package solutions with Chiplet Architecture in High Performance Computing, Graphics and Visualization Technologies.

With over 40 years' experience in the field of Semiconductor Packaging Ivor has held engineering and engineering management positions at National Semiconductor, Fairchild, VLSI Technology, LSI Logic and Xilinx. Ivor is a frequent panelist and presenter in packaging forums with deep experience in leading edge packaging solutions and high density interconnect technologies. Ivor has 20 published US patents in Semiconductor Package Manufacturing and Package Design and is a board member of MEPTEC. Ivor has a Bachelor of Science Degree in Manufacturing Technology from Napier University, Scotland, UK.

# Plenary Speakers

WEDNESDAY, OCTOBER 26

7:30AM-8:30AM

ROYAL A & B, FIRST FLOOR

**Presentation Title:**

Thermal Challenges for Future Military Platforms

**Abstract:** Modern land, sea, and air warfare technologies are trending towards significantly higher power loads with transient behavior that present unique challenges in thermal system design. Traditional design approaches assume steady state operation and rely on overdesign to meet worst-case scenarios. Moreover, advanced control techniques are virtually absent in most thermal systems. Therefore, tremendous opportunities exist to reduce the size, weight and power consumed by thermal management systems associated with these loads through the development of innovative components, the design of energy efficient system architectures, and their effective integration onto military platforms. This talk will discuss recent progress, as well as remaining research challenges, related to cooling of dynamic thermal loads.



**Mark S. Spector,**  
*Office of Naval Research*

Dr. Mark S. Spector is a Program Officer in the Advanced Naval Platforms Division at the Office of Naval Research where he manages programs in thermal science, metamaterials, and energy conversion. In addition, he sits on the Steering Committee of the Department of Defense Energy and Power Community of Interest and the NATO Applied Vehicle Technology Power and Propulsion Systems Technical Committee. Previously, he worked as a Research Physicist in the Center for Bio/Molecular Science and Engineering at the Naval Research Laboratory. He received his Ph.D. in Physics from the Massachusetts Institute of Technology and his A.B. in Physics and Applied Mathematics from University of California at Berkeley.

WEDNESDAY, OCTOBER 26

1:5PM-2:15PM

ROYAL A & B, FIRST FLOOR

**Presentation Title:**

Pushing the Boundaries of Thermal Packaging for Enhanced Performance and Energy Efficiency

**Abstract:** With the advancement of cloud technologies and data centers, artificial intelligence, machine learning, and IoT-based data communications and operations, the power consumption of information and communication technology (ICT) has skyrocketed in recent years. Datacenters alone are estimated to consume 75 TWh/yr of electricity annually (approximately 2 percent of total US electricity consumption), and this consumption is expected to grow exponentially with exploding demand. However, the chip scaling efficiency (Moore's law) reached a tipping point in 2016, and conventional and incremental technological improvements to reduce electric power consumption have reached their limit, with the efficiency curve plateauing.

To make the next leap, transformative improvements in both performance and efficiency, as well as cost reductions, are required. Inefficiencies in complex, heterogenic integration of high powder density electronics result in inefficient power use and a large amount of waste heat, both of which must be managed for the reliable and efficient operation of ICT components and systems. Microscale thermomechanics and thermal management have become increasingly important as electronics have shrunk, but they are extremely difficult to understand and control due to the transient and spatially isolated nature of components or environments. Rather than dealing with thermal management in electronic devices as an afterthought, it is critical to employ a co-design approach early in the process to enable new designs. Quantum computing is rapidly approaching as a viable and unavoidable solution, with potential end use cases in a wide range of industries. However, for large-scale and cost-effective applications, better cooling solutions are critical. Transformational designs, materials, and manufacturing methods are needed, among other things, to reduce the cost and size of the associated cryogenics systems.

I will provide an overview of ARPA-E's past and current program areas related to this problem, followed by a discussion of potential technology areas to push the boundaries of thermal materials and interfaces to enable the establishment of next generation electronics packaging.





**Philseok Kim,**  
ARPA-E

Dr. Philseok Kim is a program director at ARPA-E with a focus on functional materials and composites, engineered surfaces and structures that enable and accelerate electrification and decarbonization of energy infrastructure with high energy-efficiency, resilience, and low carbon emissions. Prior to joining ARPA-E, Dr. Kim co-founded Adaptive Surface Technologies, Inc. leveraging ARPA-E-funded SLIPS projects and launching commercial products such as fouling-resistant and fuel-saving ship hull coatings. He also co-lead SLIPS project at Harvard University to improve the energy efficiency of refrigerators by reducing frost formation and defrost time. Dr. Kim has 12 years of experience in petrochemicals, polymers, and coatings industry. Raised in South Korea, Dr. Kim received his B.S. and M.S. from Seoul National University then Ph.D. in chemistry at Georgia Institute of Technology. Dr. Kim has published over 40 papers in high-impact, peer-reviewed journals and holds about 40 issued patents in surface functionalization, materials for organic field-effect transistors, adaptive optical materials, and slippery surfaces.



**Abhinav Saxena,**  
GE Research, USA

Dr. Abhinav Saxena is a Principal Scientist in AI & Learning Systems at GE Research. Abhinav has been developing ML/AI-based PHM solutions for various industrial systems (aviation, nuclear, power, and healthcare) at GE and has been driving integration of AI-based PHM analytics in GE's industrial systems. Abhinav is also an adjunct professor in the Division of Operation and Maintenance Engineering at Luleå University of Technology, Sweden. Prior to GE, Abhinav was a Research Scientist with SGT Inc. at NASA Ames Research Center for over seven years. Abhinav's interests lie in developing PHM methods and algorithms with special emphasis on deep learning and data-driven methods in general for practical prognostics. Abhinav has published over 100 peer reviewed technical papers and has co-authored a seminal book on prognostics. He actively participates in several SAE standards committees, IEEE prognostics standards committee, and various PHM Society educational activities, and is a Fellow of the PHM Society. He also served as chief editor of International Journal of Prognostics and Health Management between 2011-2020. Abhinav actively participates in organization of PHM Society conferences and various AI workshops on topics of Digital Twins and AI in Industrial applications.

**THURSDAY, OCTOBER 27**

**7:30AM-8:30AM**

**ROYAL A & B, FIRST FLOOR**

**Presentation Title:**

Use of AI and ML in Improving Industrial Reliability towards Achieving Operational Autonomy – Successes and Challenges

**Abstract:** Predictive Maintenance (PM) is becoming ubiquitous for improving availability and reliability along with reducing O&M costs in industrial systems. Despite significant research and development investment in the last decade most deployed solutions still tend to be piecemeal (component or failure mode specific) point solutions and generally lack trust with respect to automated decision making. Full end-to-end deployment with system-wide coverage and autonomy still remains an elusive goal in industrial setting. This is primarily due to high cost and limited scalability of conventional modeling approaches for underlying complex systems and processes in large fleets. Specifically, capabilities to safe-guard against unknown-unknowns, lack of explainability and trust tend to be key bottlenecks. Given these systems are heavily instrumented generating large volumes of high-speed data and compute costs continue to go down, recent advancements in data-driven methods using machine learning (ML) and artificial intelligence (AI) have shown promise in a number of areas that previously led to valley of death between PM technology and commercialization. GE's Digital Twin technology for Predictive Maintenance is leveraging AI to bridge a number of such critical gaps that were otherwise very challenging to tackle through conventional methods. This session will enumerate key challenges in enabling system-wide predictive maintenance and how AI is being used to overcome these. Specifically, a causal deep learning-based approach will be described that provides a causal graph of inter-variable relationships allowing validation of deep learning model with domain experts. Further, by providing causal factors for identified anomalies root

# Plenary Speakers

THURSDAY, OCTOBER 27

1:15PM–2:15 PM

ROYAL A & B, FIRST FLOOR

## Presentation Title:

Multilayer Flexible Electronic Devices for IoT and RF Applications

**Abstract:** Boeing is actively engaged in the development of Flexible Hybrid Electronics. Our team prototypes various antennas, IoT devices, radar boards, and low-cost conformal phased arrays. We began with single layer processes and have expanded rapidly prototype development of multilayer flexible printed circuit boards (Flex-PCBs) for size weight power and cost saving applications. Flex PCBs allow electronics to be wrapped onto cylindrical or bi-axial curved surfaces. Conventional Flex PCBs contain either one to six copper layers with limited electronic packaging. Most devices are bonded to rigid boards that contain complex packaged electronics. Boeing's processes, however, apply copper clad or printed inks on polyimide substrates to build fully functional flex-PCBs between two and eight conductive layers thick. Thus, allowing antennas, sensors, communication links, and radars to be placed directly onto the surface of a vehicle. Similarly, power routing, and microcontrollers can conform to surfaces or interior cavities. This technology represents a transformative approach to PCBs in aerospace applications.

Our team has demonstrated this capability on RF boards with no less than 500 through vias, 100 buried vias, and 50 electronically packaged components. Complex boards can be turned in days without electroplating. Pyralux AP polyimide substrates from DuPont, Taconic, and 3M bonding adhesive achieves alignment errors of 2 mil or less over an 8 x 10 square inch area. Kapton substrates have been used with ink jet printing of particle free silver and UV curable dielectrics to create three-layer IoT devices. Vias are filled using conductive inks. Electronic packaging is currently performed using anisotropic conductive epoxy, silver ink, or low temperature solder. Cost models have been completed for printed silver devices, documenting the manufacturability from Manufacturing Readiness Levels (MRL) 4 to 6. We are currently examining pilot capability of different suppliers to manufacture devices at volumes needed for commercial activities.



**John D. Williams,**  
*Boeing*

Dr. John D. Williams received his PhD in Engineering Science from LSU in 2004 and became a NextFlex Fellow in 2019 and a Boeing Technical Fellow in 2022. John has 17 years of Principal Investigator experience in device fabrication and is currently the principal investigator on numerous NextFlex contracts focused on antenna arrays and multilayer printing on curved surfaces. John is currently developing Additive Electronics Technologies (AET) for use on Boeing platforms. From 2004 to 2014 he served as a Senior Member of the Technical Staff at Sandia National Laboratories, and as an Assistant Professor of Electrical, Optical and Material Engineering at the University of Alabama in Huntsville (UAH). He joined Boeing in 2014 and found the Boeing Research and Technology AET effort in Huntsville where his team performs novel research in microwave filters, antennas, and flexible hybrid electronic (FHE) sensors by maturing manufacturing capabilities, implementing modeling and simulation, and developing prototype demonstrators.

John is the principal / co-principal investigator for 4 concurrent NextFlex MII Projects. He has led, or co-led, 7 other NextFlex projects, serves on the NextFlex Technical Council, and is an industry co-lead for the NextFlex Materials Technical Working Group. He also serves as an industrial committee member for the ManTech JDMTP Electronics Subpanel. In 2021 he served on the organizing committee for the IEEE International Flexible Electronics Technologies Conference (IFETC). John has published more than 30 peer reviewed articles, over 30 US patents, 17 international patents, 4 Boeing trade secrets, and dozens of pending patents. John's Boeing related inventions on microwave filters, conformal antennas, hyperspectral metrology, and cryogenic cooling of MW class EMI filters are currently being developed for multiple program efforts.

## INTERPACK 2022 INTERACTIVE PRESENTATIONS (POSTERS) SCHEDULE

Poster Session - Tuesday, October 25 - 5:30PM-7:00PM

Submission Code	Author Last Name	Author First Name	Title
100329	Abusalma	Hisham	Drop Durability of Printed Hybrid Electronic (PHE) Assemblies Under Extreme Acceleration Level
99167	Bongarala	Manohar	Simultaneous High-Speed Visual and Infrared Measurements for Tracking Dryspots During Boiling Crisis
97307	Cho	Sehyeon	Numerical Prediction of Visualization and Temperature Distribution of Two Phase Closed Thermosyphon With Open Foam
99237	Choudhury	Padmanava	Evolution of Interfacial Mechanics Due to Isothermal Exposure at the Substrate-Potting Compound Interfaces Under Monotonic and Fatigue Loading
97401	Dionne	Jaymes	Crystalline-Like Thermal Transport in Disordered Interfacial Thin Films
100324	Dionne	Jaymes	Magnesium Doping Enhances Thermal Conductivity of Polymerized Fullerene Crystals
100320	Doh	Su-Yoon	Thin Flat Boiling-Driven Heat Spreader
99353	Goyal	Kartik	Effect of Temperature Exposure on Performance of Inkjet Printed Circuits With Surface Mount Components
100285	Huitink	David	Varied Phase Change Material Properties for Increased Melt Front Velocity and Heat Transfer Efficiency
100340	Huitink	David	Combined Voltage Shielding Capacity of Dielectric Fluids and Dielectric Surface Coatings
99327	Jang	Hyesoo	Characterization of Additively Printed Humidity Sensor With Super Capacitive Material Using Real-Time Artificial Neural Network Calibration and Multi-Physics Simulation for Wearable Astro-Sensor Device
88952	Kang	Minsoo	Evaporative/Boiling Wick Cooling Using Laser-Induced Graphene for Flexible Electronics
99223	Kasturi	Madhu	Characterization of Viscoelastic Properties of Underfills and Effect on Reliability of FCBGA Package Exposed to High Operating Temperature
97723	Kim	Changsu	Measurement of Effective Cure Shrinkage of Underfill Materials
100297	Kisitu	Deogratus	An Experimental Study on Two-Phase Flow Boiling in Compressed Metallic Foams for Advanced Thermal Management of High Heat Flux Electronics
98765	Kulkarni	Shriram	Print Parameter Prediction Using Deep Learning Technique to Achieve Realized Electrical Performance and Geometry on Ink-Jet Platform
100316	Lai	Yangyang	A Novel Approach to Reliability Assessment of 2nd Level Underfill in BGA Packages
97377	Lee	Haeun	Multimodal Prediction for Flow Boiling Heat Transfer
100339	Makarem	Sara	Thermal Conductivity Switch Due to Topochemical Polymerization of Organic Material
99233	Mehta	Vishal	Plastic Work Evolution and High Strain Rate Properties at Extreme Temperatures for SAC-Q Solder Alloy With Extended Durations of High Temperature Aging
100338	Murthy	Prajwal	CFD Simulation-Based Comparative Study of Forced Convection Single-Phase Liquid Immersion Cooling for a High-Powered Server

## Interactive Sessions (Posters)

Submission Code	Author Last Name	Author First Name	Title
99227	Narangaparambil	Jinesh	Performance and Reliability Characterization of Additively Printed Conductive Circuits Due to Cure-Reflow Profile and High-Temperature Operation
99225	Pandurangan	Aathi Raja Ram	Interfacial Damage Mechanics at FCBGA Chip-Underfill Interfaces Under Thermo-Mechanical Loading for Automotive Underhood Applications
97327	Pfeifer	Thomas	A Magnitude Modulated Thermoreflectance Technique for Measurements of Thermal Resistance and Heat Capacity of Thin Films and Bulk Materials
99299	Saha	Mrinmoy	Evolution of High Strain Rate Mechanical Properties of SAC+Bi Solders After 120 Days of 50°C Isothermal Aging
100267	Sattari	Romina	A Thin-Film SiC Thermal Test Chip for Reliability Monitoring in Harsh Environment
99128	Shalom	Vibin	Feasibility Study of Rear Door Heat Exchanger for a High-Capacity Data Center
99130	Sivaraju	Krishna Bhavana	Comparative Study of Single-Phase Immersion Cooled Two Socket Server in Tank and Sled Configurations
99241	Soni	Ved	Estimation of State of Health Degradation of Thin Flexible Li-Ion Batteries Subjected to Accelerated Life Cycling with Randomized Levels of Charge-Discharge and Varying C-Rates
100286	Suhling	Jeffrey	Prediction of the Effects of Structural Parameters on Overall Properties of Sac Lead Free Solder Alloys
100287	Suhling	Jeffrey	Effect of Isothermal Aging on the Evolution of Local Microscale Mechanical Properties Within SAC305 and SAC+Bi Solders
100288	Suhling	Jeffrey	Mechanical Property Evolution in Thermally Cycled SAC+Bi Lead-Free Solders
100289	Suhling	Jeffrey	Evolution of the Creep Behavior of SAC305 Solder Due to Damage Accumulation
100277	Whitt	Reece	Dual Converging Jets for Enhanced Liquid Impingement Cooling
99219	Yadav	Vikas	Materials Characterization for Thermally Aged SnAgCu Solder Alloys and Drop and Shock Simulation Using Input-G Method
100307	Zhang	Yunli	Investigation of Fatigue Life of Epoxy Molding Compounds Under High Temperature Aging Effect
100296	Zhao	Beihan	Electro-Chemical Migration (ECM) in Aerosol-Jet Printed Electronics Using Temperature-Humidity (TH) and Water Droplet (WD) Testing

COMMITTEE MEETINGS			
Date	Time	Event	Room
Monday, October 24	7:00PM–9:00 PM	InterPACK Leadership Dinner (By Invitation Only)	TBD
Tuesday, October 25	7:00PM–8:00 PM	K-16 committee Meeting	Seville
Tuesday, October 25	7:00PM–8:00 PM	EPPD Meeting	Valencia
Wednesday, October 26	5:30PM–7:00PM	InterPACK Meeting (Open)	Madrid
Wednesday, October 26	8:00PM–8:30PM	InterPACK Advisory Board Meeting	Seville
Wednesday, October 26	8:30PM–9:00PM	JEP Meeting	Valencia



# Technical Sessions

**TUESDAY, OCTOBER 25, 2022**

**01-01 HETEROGENEOUS INTEGRATION I**  
**8:30AM–10:00AM**

**REGAL**

Chair: **Amanie Abdelmessih** - *California Baptist University*

Co-Chair: **Hussameddine Kabani Kabani** - *Facebook Inc.*

**On the Viscoelastic Property Measurement of Filled Polymers by Dynamic Mechanical Analyzer (DMA)**

Technical Paper Publication: InterPACK2022-97719

**Sukrut Prashant Phansalkar** - *University of Maryland, College Park*, **Bongtae Han** - *University of Maryland, College Park*, **Ehsan Akbari** - *TA Instruments - Waters LLC*, **Paulius Vaitiekunas** - *TA Instruments - Waters LLC*

**Numerical Modeling and Experimental Validation on Non-Contact Bernoulli Picker for 3D Device Stacking Process**

Technical Paper Publication: InterPACK2022-97218

**Daeho Min** - *Mechatronics Research*, **Minsoo Han** - *Mechatronics Research*, **Juno Kim** - *Mechatronics Research*, **Kangsan Lee** - *Mechatronics Research*, **Kyeongbin Lim** - *Mechatronics Research*, **Euisun Choi** - *Mechatronics Research*, **Seung Dae Seok** - *Mechatronics Research*, **Byeongjun Lee** - *Mechatronics Research*, **Minwoo Daniel Rhee** - *Mechatronics Research*

**Evaluation of Electromigration Coupling Different Physics Fields in Numerical Simulation**

Technical Paper Publication: InterPACK2022-97338

**Chongyang Cai** - *Binghamton University*, **Jiefeng Xu** - *Binghamton University*, **Yangyang Lai** - *Binghamton University*, **Junbo Yang** - *Binghamton University*, **Huayan Wang** - *AMD Inc.*, **Suresh Ramalingam** - *AMD Inc.*, **Gamal Refai-Ahmed** - *AMD Inc.*, **Seungbae Park** - *Binghamton University*

**02-01 IMMERSION COOLING I**  
**8:30AM–10:00AM**

**VALENCIA**

Chair: **Jimil M. Shah** - *TMGcore, Inc.*

Co-Chair: **Saket Karajgikar** - *Facebook Inc.*

**Power Density in the Context of Two-Phase Immersion Cooling**

Technical Paper Publication: InterPACK2022-96370

**Jimil M. Shah** - *TMGcore, Inc.*, **Phillip Tuma** - *3M*

**A Critical Heat Flux Model for Pool Boiling Based on Two Different Mechanisms**

Technical Presentation Only: InterPACK2022-97309

**Minchang Kim** - *Korea Advanced Institute of Science and Technology*, **Sung Jin Kim** - *Korea Advanced Institute of Science and Technology*

**CFD Simulation-Based Comparative Study of Forced Convection Single-Phase Liquid Immersion Cooling for a High-Powered Server**

Technical Paper Publication: InterPACK2022-97402

**Prajwal Murthy** - *The University of Texas at Arlington*, **Gautam Gupta** - *The University of Texas at Arlington*, **Joseph Herring** - *The University of Texas at Arlington*, **Jacob Lamotte-Dawaghreh** - *The University of Texas at Arlington*, **Krishna Bhavana Sivaraju** - *The University of Texas at Arlington*, **Pratik Bansode** - *The University of Texas at Arlington*, **Himanshu Modi** - *The University of Texas at Arlington*, **Dereje Agonafer** - *The University of Texas at Arlington*, **Poornima Mynampati** - *Silent-Aire*, **Mike Sweeney** - *Silent-Aire*

**Server Benchmarking, Thermal Performance, and Efficiency of a Single-Phase Immersion Cooling System**

Technical Presentation Only: InterPACK2022-97409

**Jimil M. Shah** - *TMGcore, Inc.*, **Andrew Downs** - *TMGcore, Inc.*, **Seamus Egan** - *TMGcore, Inc.*, **Murad Kheraj** - *TMGcore, Inc.*, **Kiran Patel** - *TMGcore, Inc.*, **Kaden Elfstrom** - *TMGcore, Inc.*

## 03-01 FLEXIBLE ELECTRONICS FOR RF & MULTI-LAYER APPLICATIONS

8:30AM-10:00AM

MADRID

Chair: Pradeep Lall - *Auburn University*

### Additive Manufacturing for Advanced Packaging Applications

Technical Presentation Only: InterPACK2022-99127

Alkim Akyurtlu - *University of Massachusetts Lowell*

### Fabric-Based Printed Metasurfaces for Microwave Applications

Technical Presentation Only: InterPACK2022-99154

Adria Kajenski - *University of Massachusetts Lowell*, Guinevere Strack - *University of Massachusetts Lowell*, Shahriar Khushrushahi - *Notch Inc.*, Alkim Akyurtlu - *University of Massachusetts Lowell*

### Additive Manufacturing of Radiofrequency

Technical Presentation Only: InterPACK2022-99346

Mark Mirotznik - *The University of Delaware*

## 08-03 MATERIALS

8:30AM-10:00AM

GRANADA

Chair: Abhishek Deshpande - *Qualcomm Technologies*

Co-Chair: Pavan Rajmane - *Qualcomm*

### RoHS Compliant Indirectly Material Evaluation for Manufacturing Study

Technical Paper Publication: InterPACK2022-97175

Fenny Liu - *Siliconware Precision Industries Co. Ltd.*, Sean Huang - *Siliconware Precision Industries Co. Ltd.*, Sheng Fong Yu - *Siliconware Precision Industries Co. Ltd.*, Chun Yen Li - *Siliconware Precision Industries Co. Ltd.*, Liang-Yih - *Siliconware Precision Industries Co. Ltd.*, Yu Po Wang - *Siliconware Precision Industries Co. Ltd.*

### Electroless Nickel Plating and Its Impact on Aluminum Wire Bonds Under Electromigration Conditions

Technical Presentation Only: InterPACK2022-100290

Whit Vinson - *University of Arkansas*, Johns Harris - *University of Arkansas*, David Huitink - *University of Arkansas*

### The Improvement of Mechanical Properties and Reliability of Hybrid Soldering Joints by Novel Nano-Structured Silver Particles

Technical Presentation Only: InterPACK2022-98954

Jaeseok Jang - *Samsung Electronics / Sungkyunkwan University*, Seunghyun Baik - *Sungkyunkwan University*

### A Structure-Property Study on SAC Alloys

Technical Presentation Only: InterPACK2022-97475

Debabrata Mondal - *Auburn University*, Elham Mirkoohi - *Auburn University*, Jeffrey Suhling - *Auburn University*, Pradeep Lall - *Auburn University*

## 06-01 TWO-PHASE COOLING

10:15AM-11:45AM

MADRID

Chair: Ange Christian Iradukunda - *University of Arkansas*

Chair: Jungwan Cho - *Sungkyunkwan University*

### Simultaneous High-Speed Visual and Infrared Measurements for Tracking Dryspots During Boiling Crisis

Technical Presentation Only: InterPACK2022-99165

Manohar Bongarala - *Purdue University*, Justin Weibel - *Purdue University*, Suresh Garimella - *University of Vermont*

### Comparative Analysis of Direct and Indirect Cooling of Wide-Bandgap Power Modules and Performance Enhancement of Jet Impingement-Based Direct Substrate Cooling

Technical Paper Publication: InterPACK2022-97172

Himel Barua - *Oak Ridge National Laboratory*, Emre Gurpinar - *Oak Ridge National Laboratory*, Lincoln Xue - *Oak Ridge National Laboratory*, Burak Ozpineci - *Oak Ridge National Laboratory*

# Technical Sessions

## 02-02 IMMERSION COOLING II

10:15AM–11:45AM

VALENCIA

Chair: Saket Karajgikar - Facebook Inc.

Co-Chair: Cheng Chen - Facebook Inc.

### Machine Learning-Based Heat Sink Optimization Model for Single-Phase Immersion Cooling

Technical Paper Publication: InterPACK2022-97481

Joseph Herring - The University of Texas at Arlington, Peter Smith - Georgia Institute of Technology, Jacob Lamotte-Dawagreh - The University of Texas at Arlington, Pratik Bansode - The University of Texas at Arlington, Satyam Saini - The University of Texas at Arlington, Rabin Bhandari - The University of Texas at Arlington, Dereje Agonafer - The University of Texas at Arlington

### Single-Phase Immersion Cooling Study of a High-Density Storage System

Technical Paper Publication: InterPACK2022-97490

Saket Karajgikar - Facebook Inc., Jasper Kidger - Iceotope, Andrew Shaw - Iceotope, Neil Edmunds - Iceotope Technologies, Veerendra Mulay - Meta

### Thermal Test Vehicle (TTV) Performance of 2-Phase Immersion Boiler Assemblies

Technical Presentation Only: InterPACK2022-100309

Jimil M. Shah - TMGcore Inc., Phillip Tuma - 3M

### Experimental Investigation of the Heat Transfer Characteristics of Aluminum-Foam Heat Sink Immersed in Dielectric Synthetic Fluid

Technical Presentation Only: InterPACK2022-99137

Pratik Bansode - The University of Texas at Arlington, Gautam Gupta - The University of Texas at Arlington, Mohan Sai Ramalingam - The University of Texas at Arlington, Tushar Wagh - The University of Texas at Arlington, Satyam Saini - The University of Texas at Arlington, Pardeep Shahi - The University of Texas at Arlington, Vibin Simon - The University of Texas at Arlington, Rabin Bhandari - The University of Texas at Arlington, Amrutha Rachakonda - The University of Texas at Arlington, Dereje Agonafer - The University of Texas at Arlington

## 08-04 INTERCONNECTIONS

10:15AM–11:45AM

GRANADA

Chair: Pavan Rajmane - Qualcomm Technologies

Co-Chair: Abhishek Deshpande - Qualcomm Technologies

### Thermomechanical Reliability of BGA Packages with Different Underfill Reinforcement Methods

Technical Paper Publication: InterPACK2022-97349

Yangyang Lai - Binghamton University, Chongyang Cai - Binghamton University, Ke Pan - Binghamton University, Junbo Yang - Binghamton University, Jonghwan Ha - Binghamton University, Pengcheng Yin - Binghamton University, Karthik Deo - Binghamton University, Seungbae Park - Binghamton University

### Study of Interface Monotonic and Fatigue Fracture Measurements at the Substrate Potting Compound Interfaces Under Flexure Loading

Technical Paper Publication: InterPACK2022-97448

Pradeep Lall - Auburn University, Padmanava Chourdury - Auburn University, Kenneth Blecker - U.S. Army Combat Capabilities Development Command - Armament Center

### A Study on Parameters That Impact the Thermal Fatigue Life of BGA Solder Joints

Technical Paper Publication: InterPACK2022-97253

Karthik Arun Deo - Binghamton University, Raymond-Noel Kono - Microsoft Corporation, Chongyang Cai - Binghamton University, State University of New York, Junbo Yang - Binghamton University, State University of New York, Yangyang Lai - Binghamton University, State University of New York, Seungbae Park - Binghamton University, State University of New York

### Effects of Mechanical Cycling Induced Damage on the Creep Response of SAC305 Solder

Technical Paper Publication: InterPACK2022-93878

Golam Rakib Mazumder - Auburn University, Mohammad Ashraful Haq - Auburn University, Jeffrey C. Suhling - Auburn University, Pradeep Lall - Auburn University



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**07-01 HARSH ENVIRONMENT ELECTRONIC APPLICATIONS FOR TRANSPORTATION SYSTEMS**  
**2:15PM-3:45PM**

**MADRID**

Chair: Fabian Welschinger - Robert Bosch GmbH  
 Co-Chair: Bhanu Sood - NASA

**Machine Learning Enables Autonomous Vehicles Under Extreme Environmental Conditions**

Technical Paper Publication: InterPACK2022-96542

Nhi Vu Quach - University of California, Irvine, Jewoo Park - University of California, Irvine, Yonghwi Kim - Korea Electronics Technology Institute, Ruy-Hwa Cheng - University of California, Irvine, Michal Jenco - University of California, Irvine, Alex K. Lee - University of California, Irvine, Chenxi Yin - University of California, Irvine, Yoonjin Won - University of California, Irvine

**Evolution of Propensity for Chip-UF FCBGA Interface Delamination Under Fatigue-Loading and Sustained High Automotive Temperatures**

Technical Paper Publication: InterPACK2022-97424

Pradeep Lall - Auburn University, Aathi Pandurangan - Auburn University, Jaimal Williamson - Texas Instruments

**Improved Internal Short Circuit Models for Thermal Runaway Simulations in Lithium-Ion Batteries**

Technical Presentation Only: InterPACK2022-96774

Bakhshish Preet Singh - University of Illinois at Urbana-Champaign, Yashraj Gurumukhi - University of Illinois at Urbana-Champaign, Hao Wu - Ford Motor Company, Myung Ki Sung - Ford Motor Company, Nenad Miljkovic - University of Illinois at Urbana Champaign

**Effect of Property Evolution of Doped and Undoped SnAgCu Solder Alloys Under Shock and Vibration**

Technical Paper Publication: InterPACK2022-97452

Pradeep Lall - Auburn University, Vikas Yadav - Auburn University, Jeff Suhling - Auburn University, David Locker - U.S. Army Combat Capabilities Development Command - AvMC

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**05-01 WIDE-BANDGAP POWER ELECTRONICS**  
**2:15PM-3:45PM**

**REGAL**

Chair: Paul Paret - National Renewable Energy Laboratory

**Experimental Probing of the Bias Dependent Self-Heating in AlGaIn/GaN HEMTs with a Transparent Indium Tin Oxide Gate**

Technical Paper Publication: InterPACK2022-98800

Anwarul Karim - The Pennsylvania State University, Tae Kyoung Kim - Korea Institute of Energy Technology, Daniel Shoemaker - The Pennsylvania State University, Yiwen Song - The Pennsylvania State University, Joon Seop Kwak - Korea Institute of Energy, Sukwon Choi - The Pennsylvania State University

**Design of Buck Converter with Control System for Electric Vehicle Using SiC Device with Thermal Loss Model**

Technical Paper Publication: InterPACK2022-97669

Utsav Gupta - The Ohio State University, Andras Vass-Varnai - Siemens

**Multiphysics Co-Optimization Design and Analysis of a Double-Side-Cooled Silicon Carbide-Based Power Module**

Technical Paper Publication: InterPACK2022-97355

Xuhui Feng - National Renewable Energy Laboratory, Gilbert Moreno - National Renewable Energy Laboratory, Sreekant Narumanchi - National Renewable Energy Laboratory, Paul Paret - National Renewable Energy Laboratory

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**02-03 DATA CENTER COOLING I**  
**2:15PM-3:45PM**

**VALENCIA**

Chair: Rajesh Kasukurthy - Meta  
 Co-Chair: Ali Heydari - NVIDIA

**Predictions of Airside Economization-Based Air-Cooled Data Center Environmental Burden Reduction**

Technical Paper Publication: InterPACK2022-92005

Li Chen - Villanova University, Aaron Wemhoff - Villanova University

# Technical Sessions

## Power Usage Effectiveness Analysis of a High-Density Air-Liquid Hybrid Cooled Data Center

Technical Paper Publication: InterPACK2022-97447

Ali Heydari - NVIDIA Corporation, Bahareh Eslami - NVIDIA Corporation, Vahideh Radmard - NVIDIA Corporation, Fred Rebarber - Vertiv Corporation, Tyler Buell - Vertiv Corporation, Kevin Gray - Vertiv Corporation, Sam Sather - Vertiv Corporation, Jeremy Rodriguez - NVIDIA Corporation

## Data Driven Modeling Advancements for Thermal Predictions in Data Center Applications

Technical Paper Publication: InterPACK2022-97478

Dhaval Patel - Georgia Institute of Technology, Yogendra Joshi - Georgia Institute of Technology

## Feasibility Study of Rear Door Heat Exchanger for a High-Capacity Data Center

Technical Paper Publication: InterPACK2022-97494

Vibin Simon - The University of Texas at Arlington, Himanshu Modi - The University of Texas at Arlington, Krishna Bhavana Sivaraju - University of Texas at Arlington, Pratik Bansode - The University of Texas at Arlington, Satyam Saini - The University of Texas at Arlington, Pradeep Shahi - The University of Texas at Arlington, Saket Karajgikar - Facebook Inc., Veerendra Mulay - Meta, Dereje Agonafer - The University of Texas at Arlington

## High Strain Rate Properties and Evolution of Plastic-Work for Doped Solder SAC-Q for Isothermal Aging Up to 240-Days at 100°C

Technical Paper Publication: InterPACK2022-97438

Pradeep Lall - Auburn University, Vishal Mehta - Auburn University, Jeff Suhling - Auburn University, Ken Blecker - U.S. Army Combat Capabilities Development Command - Armament Center

## Microstructural Evolution of SAC+Bi Lead-Free Solder Materials Subjected to Different Thermal Cycling Exposures

Technical Presentation Only: InterPACK2022-97464

Mohammad Al Ahsan - Auburn University, Sm Kamrul Hasan - Auburn University, Mohammad Ashraful Haq - Auburn University, Jeffrey Suhling - Auburn University, Pradeep Lall - Auburn University

## Study of the Local Microscale Mechanical Properties within SAC305 and SAC+Bi Solders Subjected to Isothermal Aging

Technical Presentation Only: InterPACK2022-97491

Souvik Chakraborty - Auburn University, Mohammad Al Ahsan - Auburn University, Mohammad Ashraful Haq - Auburn University, Jeffrey Suhling - Auburn University, Pradeep Lall - Auburn University

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## 08-05 LEAD FREE SOLDERS

2:15PM-3:45PM

GRANADA

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Chair: Alexander Otto - Fraunhofer ENAS

Co-Chair: David Huitink - University of Arkansas

## Effect of Aging on High Strain Rate Mechanical Properties of SAC+Bi Solders After Exposure to Isothermal Aging of 50°C Up To 120 Days

Technical Paper Publication: InterPACK2022-97449

Pradeep Lall - Auburn University, Mrinmoy Saha - Auburn University, Jeff Suhling - Auburn University, Ken Blecker - U.S. Army Combat Capabilities Development Command - Armament Center

## 05-02 ADVANCED COOLING TECHNOLOGIES 1

4:00PM–5:30PM

REGAL

Chair: Palash Acharya - *Qualcomm*

Co-Chair: Bladimir Ramos-Alvarado - *Penn State*

### Additive-Manufacturing-Enabled Polymer-Metal Hybrid Liquid Cooled Thermal Management Solution for Discrete Semiconductor Packages

Technical Presentation Only: InterPACK2022-94092

Aniket Ajay Lad - *University of Illinois at Urbana-Champaign*, Muhammad Jahidul Hoque - *University of Illinois at Urbana-Champaign*, Shamar Christian - *University of Arkansas*, Juan Balda - *University of Arkansas*, Yue Zhao - *University of Arkansas*, William King - *University of Illinois at Urbana-Champaign*, Nenad Miljkovic - *University of Illinois at Urbana-Champaign*

### 3-D Manifold Micro-Fin Heat Sink for Silicon-Based Embedded Cooling of Ultra-High Heat Flux Electronics

Technical Presentation Only: InterPACK2022-97290

Young Jin Lee - *Korea Advanced Institute of Science and Technology*, Sung Jin Kim - *Korea Advanced Institute of Science and Technology*

### Investigation of Silicon Carbide Embedded Cooling Technology for Compact Electronic Systems

Technical Presentation Only: InterPACK2022-97380

Jarred Wilhite - *NASA Glenn Research Center*, Chirag Kharangate - *Case Western Reserve University*

### Thermal Optimization of a Silicon Carbide, Half-Bridge Power Module

Technical Paper Publication: InterPACK2022-97283

Gilberto Moreno - *National Renewable Energy Laboratory*, Joshua Major - *National Renewable Energy Laboratory*, Douglas Devoto - *National Renewable Energy Laboratory*, Faisal Khan - *National Renewable Energy Laboratory*, Sreekant Narumanchi - *National Renewable Energy Laboratory*, Xuhui Feng - *National Renewable Energy Laboratory*, Paul Paret - *National Renewable Energy Laboratory*

## 02-04 DATA CENTER COOLING II

4:00PM–5:30 PM

VALENCIA

Chair: Jayati Athavale - *Facebook Inc.*

Chair: Dr. Pritish Parida - *IBM Research*

### Hardware Utilization Effectiveness

Technical Presentation Only: InterPACK2022-98783

Jayati Athavale - *Facebook Inc.*, Anthony Chan - *Meta Inc.*, Richa Mishra - *Meta Inc.*, Andrew Grier - *Meta Inc.*

### Liquid to Air Cooling for High Heat Density Liquid Cooled Data Centers

Technical Paper Publication: InterPACK2022-97386

Ali Heydari - *NVIDIA*, Vahideh Radmard - *Binghamton University*, Bahareh Eslami - *NVIDIA*, Mohammad Tradat - *Binghamton University*, Yaman Manaserh - *NVIDIA*, Harold Miyamura - *NVIDIA*, Uschas Chowdhury - *NVIDIA*, Pardeep Shahi - *NVIDIA*, Kevin Dave Hall - *Binghamton University*, Bahgat Sammakia - *Binghamton University*, Jeremy Rodriguez - *NVIDIA*

### Direct-to-Chip Two-Phase Cooling for High Heat Flux Processors

Technical Paper Publication: InterPACK2022-97047

Ali Heydari - *NVIDIA*, Yaman Manaserh - *NVIDIA*, Ahmad Abubakar - *Villanova University*, Carol Caceres - *Villanova University*, Harold Miyamura - *NVIDIA*, Alfonso Ortega - *Villanova University*, Jeremy Rodriguez - *NVIDIA*

### Liquid to Liquid Cooling for High Heat Density Liquid Cooled Data Centers

Technical Paper Publication: InterPACK2022-97416

Ali Heydari - *NVIDIA*, Pardeep Shahi - *The University of Texas Arlington*, Vahideh Radmard - *NVIDIA*, Bahareh Eslami - *NVIDIA*, Uschas Chowdhury - *NVIDIA*, Satyam Saini - *The University of Texas at Arlington*, Pratik Bansode - *The University of Texas at Arlington*, Harold Miyamura - *NVIDIA*, Dereje Agonafer - *The University of Texas at Arlington*, Jeremy Rodriguez - *NVIDIA*

# Technical Sessions

## 06-03 THERMAL MATERIALS SECTION 1

4:00PM–5:30PM

MADRID

Chair: Chirag Kharangate - Case Western Reserve University

Chair: Hyoungsoon Lee - Chung-Ang University

### Validation of an All-Fiber Frequency-Domain Thermoreflectance System

Technical Presentation Only: InterPACK2022-96896

Ronald Warzoha - United States Naval Academy, Lian Dunlevy - United States Naval Academy, Brian Donovan - United States Naval Academy, Adam Wilson - U.S. DEVCOM Army Research Laboratory, Pete Brereton - United States Naval Academy

### High Thermal Conductivity and Ultra-Low-K Dielectric Constants in Two-Dimensional Polymers

Technical Presentation Only: InterPACK2022-97279

Ashutosh Giri - University of Rhode Island, Patrick Hopkins - University of Virginia

### Nanoscale Mechanisms for Reducing Thermal Boundary Resistance via Ion Bombardment

Technical Presentation Only: InterPACK2022-97323

Thomas Pfeifer - University of Virginia, Ethan Scott - Sandia National Laboratories, Ashutosh Giri - University of Rhode Island, John Tomko - University of Virginia, Khalid Hattar - Sandia National Laboratories, Patrick Hopkins - University of Virginia

### Interface Independent Sound Speed and Thermal Conductivity of Amorphous AlN/Al<sub>2</sub>O<sub>3</sub> Multilayers

Technical Presentation Only: InterPACK2022-97354

Md. Shafkat Bin Hoque - University of Virginia

## 10-01 INTERACTIVE PRESENTATIONS (POSTERS)

5:30PM–7:00PM

ROYAL E & F

Chair: Solomon Adera - University of Michigan

### Evaporative/boiling Wick Cooling Using Laser-Induced Graphene for Flexible Electronics

Student Poster Presentation: InterPACK2022-88952

Minsoo Kang - Chung-Ang University, Daeyoung Kong - Chung-Ang University, Jungbae Lee - Chung-Ang University, Jung Bin Lin - Chung-Ang University, Hyoungsoon Lee - Chung-Ang University

### Numerical Prediction of Visualization and Temperature Distribution of Two Phase Closed Thermosyphon with Openfoam

Student Poster Presentation: InterPACK2022-97307

Sehyeon Cho - Chung-Ang University, Daeyoung Kong - Chung-Ang University, Gyohoon Geum - Chung-Ang University, Jun Soo Kim - Chung-Ang University, Hyoungsoon Lee - Chung-Ang University, Seong Hyuk Lee - Chung-Ang University, Jungho Lee - Ajou University

### Feasibility Study of Rear Door Heat Exchanger for a High-Capacity Data Center

Student Poster Presentation: InterPACK2022-99128

Vibin Shalom Simon - The University of Texas at Arlington, Himanshu Modi - The University of Texas at Arlington, Krishna Bhavana Sivaraju - The University of Texas at Arlington, Pratik Bansode - The University of Texas at Arlington, Satyam Saini - The University of Texas at Arlington, Pardeep Shahi - The University of Texas at Arlington, Saket Karajgikar - Meta, Veerendra Mulay - Meta, Dereje Agonafer - The University of Texas at Arlington

### Comparative Study of Single-Phase Immersion Cooled Two Socket Server in Tank and Sled Configurations

Student Poster Presentation: InterPACK2022-99130

Krishna Bhavana Sivaraju - The University of Texas at Arlington, Pratik Bansode - The University of Texas at Arlington, Gautam Gupta - The University of Texas at Arlington, Jacob Lamotte-Dawaghreh - The University of Texas at Arlington, Satyam Saini - The University of Texas at Arlington, Vibin Simon - The University of Texas at Arlington, Saket Karajgikar - Meta, Veerendra Mulay - Meta, Dereje Agonafer - The University of Texas at Arlington

## **Simultaneous High-Speed Visual and Infrared Measurements for Tracking Dryspots During Boiling Crisis**

Student Poster Presentation: InterPACK2022-99167

Manohar Bongarala - *Purdue University*, Justin Weibel - *Purdue University*, Suresh Garimella - *University of Vermont*

## **Materials Characterization for Thermally Aged SnAgCu Solder Alloys and Drop and Shock Simulation Using Input-G Method**

Student Poster Presentation: InterPACK2022-99219

Vikas Yadav - *Auburn University*, Pradeep Lall - *Auburn University*

## **Characterization of Viscoelastic Properties of Underfills and Effect on Reliability of FCBGA Package Exposed to High Operating Temperature**

Student Poster Presentation: InterPACK2022-99223

Madhu Kasturi - *Auburn University*, Pradeep Lall - *Auburn University*, Haotian Wu - *Auburn University*, Edward Davis - *Auburn University*

## **Interfacial Damage Mechanics at FCBGA Chip-Underfill Interfaces Under Thermo-Mechanical Loading for Automotive Underhood Applications**

Student Poster Presentation: InterPACK2022-99225

Aathi Raja Ram Pandurangan - *Auburn University*, Pradeep Lall - *Auburn University*

## **Performance and Reliability Characterization of Additively Printed Conductive Circuits Due to Cure-Reflow Profile and High-Temperature Operation**

Student Poster Presentation: InterPACK2022-99227

Jinesh Narangaparambil - *Auburn University*, Pradeep Lall - *Auburn University*

## **Evolution of Interfacial Mechanics Due to Isothermal Exposure at the Substrate-Potting Compound Interfaces Under Monotonic and Fatigue Loading**

Student Poster Presentation: InterPACK2022-99237

Padmanava Choudhury - *Auburn University*, Pradeep Lall - *Auburn University*

## **Estimation of State of Health Degradation of Thin Flexible Li-Ion Batteries Subjected to Accelerated Life Cycling with Randomized Levels of Charge-Discharge and Varying C-Rates**

Student Poster Presentation: InterPACK2022-99241

Ved Soni - *Auburn University*, Pradeep Lall - *Auburn University*

## **A Magnitude Modulated Thermoreflectance Technique for Measurements of Thermal Resistance and Heat Capacity of Thin Films and Bulk Materials**

Student Poster Presentation: InterPACK2022-97327

Thomas Pfeifer - *University of Virginia*, Sara Makarem - *University of Virginia*, Patrick Hopkins - *University of Virginia*

## **Characterization of Additively Printed Humidity Sensor with Super Capacitive Material Using Real-Time Artificial Neural Network Calibration and Multi-Physics Simulation for Wearable Astro-Sensor Device**

Student Poster Presentation: InterPACK2022-99327

Hyesoo Jang - *Auburn University*, Pradeep Lall - *Auburn University*

## **Investigation of Fatigue Life of Epoxy Molding Compounds Under High Temperature Aging Effect**

Student Poster Presentation: InterPACK2022-99391

Yunli Zhang - *Auburn University*

## **A Thin-Film SiC Thermal Test Chip for Reliability Monitoring in Harsh Environment**

Student Poster Presentation: InterPACK2022-100267

Romina Sattari - *Delft University of Technology*, Henk Van Zeijl - *Delft University of Technology*, Guoqi Zhang - *Delft University of Technology*

## **Dual Converging Jets for Enhanced Liquid Impingement Cooling**

Student Poster Presentation: InterPACK2022-100277

Reece Whitt - *University of Arkansas*, Rafael Estrella - *University of Arkansas*, David Huitink - *University of Arkansas*

## **Varied Phase Change Material Properties for Increased Melt Front Velocity and Heat Transfer Efficiency**

Student Poster Presentation: InterPACK2022-100285

David Huitink - *University of Arkansas*, Joshua Kasitz - *University of Arkansas*, Larry Marshall Jr. - *University of Arkansas*

## **Prediction of the Effects of Structural Parameters on Overall Properties of Sac Lead Free Solder Alloys**

Student Poster Presentation: InterPACK2022-100286

Debabrata Mondal - *Auburn University*, Elham Mirkoohi - *Auburn University*, Jeffrey Suhling - *Auburn University*, Pradeep Lall - *Auburn University*

## **Effect of Isothermal Aging on the Evolution of Local Microscale Mechanical Properties within SAC305 and SAC+Bi Solders**

Student Poster Presentation: InterPACK2022-100287

Souvik Chakraborty - *Auburn University*, Mohammad Al Ahsan - *Auburn University*, Mohammad Ashraful Haq - *Auburn University*, Jeffrey Suhling - *Auburn University*, Pradeep Lall - *Auburn University*

## **Mechanical Property Evolution in Thermally Cycled SAC+Bi Lead-Free Solders**

Student Poster Presentation: InterPACK2022-100288

Mohammad Al Ahsan - *Auburn University*, Sm Kamrul Hasan - *Auburn University*, Mohammad Ashraful Haq - *Auburn University*, Jeffrey Suhling - *Auburn University*, Pradeep Lall - *Auburn University*

## **Evolution of the Creep Behavior of SAC305 Solder Due to Damage Accumulation**

Student Poster Presentation: InterPACK2022-100289

Golam Rakib Mazumder - *Auburn University*, Mohammad Ashraful Haq - *Auburn University*, Jeffrey Suhling - *Auburn University*, Pradeep Lall - *Auburn University*

## **Electro-Chemical Migration (ECM) in Aerosol-Jet Printed Electronics Using Temperature-Humidity (TH) and Water Droplet (WD) Testing**

Student Poster Presentation: InterPACK2022-100296

Beihan Zhao - *University of Maryland, College Park*, Aniket Bharamgonda - *University of Maryland, College Park*, Eric Jennings - *University of Maryland, College Park*, Robert Utter - *University of Maryland, College Park*, Michael Osterman - *University of Maryland, College Park*, Michael Azarian - *University of Maryland, College Park*, Siddhartha Das - *University of Maryland, College Park*, Abhijit Dasgupta - *University of Maryland, College Park*, Jason Fleischer - *Laboratory for Physical Science*, Edwin Quinn - *Laboratory for Physical Sciences*, Daniel Hines - *Laboratory for Physical Sciences*

## **Multimodal Prediction for Flow Boiling Heat Transfer**

Student Poster Presentation: InterPACK2022-97377

Haeun Lee - *Chung-Ang University*, Chirag R. Kharangate - *Case Western Reserve University*, Hyungsoon Lee - *Chung-Ang University*

## **An Experimental Study on Two-Phase Flow Boiling in Compressed Metallic Foams for Advanced Thermal Management of High Heat Flux Electronics**

Student Poster Presentation: InterPACK2022-100297

Deogratius Kisitu - *Villanova University*, Carol Caceres - *Villanova University*, Metodi Zlatinov - *ERG Aerospace Corporation*, Denver Schaffarzick - *ERG Aerospace Corporation*, Alfonso Ortega - *Villanova University*

## **Investigation of Fatigue Life of Epoxy Molding Compounds Under High Temperature Aging Effect**

Student Poster Presentation: InterPACK2022-100307

Yunli Zhang - *Auburn University*, Pradeep Lall - *Auburn University*

## **A Novel Approach to Reliability Assessment of 2nd Level Underfill in BGA Packages**

Student Poster Presentation: InterPACK2022-100316

Yangyang Lai - *Binghamton University*, Seungbae Park - *Binghamton University*

## Thin Flat Boiling-Driven Heat Spreader

Student Poster Presentation: InterPACK2022-100320

Su-Yoon Doh - *Ajou University*, Hyunmuk Lim - *Ajou University*, Dong Hwan Shin - *Korea Institute of Machinery & Materials*, Seung M. You - *The University of Texas at Dallas*, Jungho Lee - *Ajou University*

## Magnesium Doping Enhances Thermal Conductivity of Polymerized Fullerene Crystals

Student Poster Presentation: InterPACK2022-100324

Jaymes Dionne - *University of Rhode Island*, Ashutosh Giri - *University of Rhode Island*

## Drop Durability of Printed Hybrid Electronic (PHE) Assemblies Under Extreme Acceleration Level

Student Poster Presentation: InterPACK2022-100329

Hisham Abusalma - *University of Maryland*, Abhijit Dasgupta - *University of Maryland*, Andres Bujanda - *Army Research Laboratory*, Jian Yu - *Army Research Laboratory*, Harvey Tsang - *Army Research Laboratory*

## CFD Simulation-Based Comparative Study of Forced Convection Single-Phase Liquid Immersion Cooling for a High-Powered Server

Student Poster Presentation: InterPACK2022-100338

Prajwal Murthy - *University of Texas at Arlington*, Gautam Gupta - *The University of Texas at Arlington*, Joseph Herring - *The University of Texas at Arlington*, Jacob Lamotte Dawaghereh - *The University of Texas at Arlington*, Krishna Bhavana Sivaraju - *The University of Texas at Arlington*, Pratik Bansode - *The University of Texas at Arlington*, Himanshu Modi - *The University of Texas at Arlington*, Dereje Agonafer - *The University of Texas at Arlington*, Poornima Mynampati - *Silent-Aire*, Mike Sweeney - *Silent-Aire*

## Crystalline-Like Thermal Transport in Disordered Interfacial Thin Films

Student Poster Presentation: InterPACK2022-97401

Jaymes Dionne - *University of Rhode Island*, Ashutosh Giri - *University of Rhode Island*

## Thermal Conductivity Switch Due to Topochemical Polymerization of Organic Material

Student Poster Presentation: InterPACK2022-100339

Sara Makarem - *University of Virginia*

## Combined Voltage Shielding Capacity of Dielectric Fluids and Dielectric Surface Coatings

Student Poster Presentation: InterPACK2022-100340

David Huitink - *University of Arkansas*, Ange Christian Iradukunda - *University of Arkansas*, Tarek Gebrael - *University of Illinois at Urbana-Champaign*, Nenad Miljkovic - *University of Illinois at Urbana-Champaign*

## Non-Axisymmetric Micropillar-Based Wick for Thin-Film Evaporation

Student Poster Presentation: InterPACK2022-100350

Vivek Manepalli - *University of Maryland, College Park*, Kidus Guye - *University of Maryland, College Park*, Suhul Kebede - *Washington University in St. Louis*, Damena Agonafer - *University of Maryland, College Park*

## A Simple Analytical Design Tool for the Conduction Shape Factor of Conventionally Mounted Heat Spreaders and Sinks

Student Poster Presentation: InterPACK2022-98060

Callum Chhokar - *Simon Fraser University*, G. Bamorovat Abadi - *Simon Fraser University*, Majid Bahrami - *Simon Fraser University*

## Measurement of Effective Cure Shrinkage of Underfill Materials

Student Poster Presentation: InterPACK2022-97723

Changsu Kim - *University of Maryland*, Bongtae Han - *University of Maryland*

## Plastic Work Evolution and High Strain Rate Properties at Extreme Temperatures for SAC-Q Solder Alloy with Extended Durations of High Temperature Aging

Student Poster Presentation: InterPACK2022-99233

Vishal Mehta - *Auburn University*, Pradeep Lall - *Auburn University*, Jeff Suhling - *Auburn University*, Ken Blecker - *U.S. Army Combat Capabilities Development Command - Armament Center*

# Technical Sessions

## Evolution of High Strain Rate Mechanical Properties of SAC+Bi Solders After 120 Days of 50°C Isothermal Aging

Student Poster Presentation: InterPACK2022-99299

Mrinmoy Saha - Auburn University, Pradeep Lall - Auburn University, Jeffrey Suhling - Auburn University

## Effect of Temperature Exposure on Performance of Inkjet Printed Circuits with Surface Mount Components

Student Poster Presentation: InterPACK2022-99353

Kartik Goyal - Auburn University, Pradeep Lall - Auburn University, Scott Miller - NextFlex Institute

## Print Parameter Prediction Using Deep Learning Technique to Achieve Realized Electrical Performance and Geometry on Ink-Jet Platform

Student Poster Presentation: InterPACK2022-98765

Shriram Kulkarni - Auburn University, Pradeep Lall - Auburn University, Kartik Goyal - Auburn University, Scott Miller - NextFlex

## WEDNESDAY, OCTOBER 26, 2022

### TRACK 4 KEYNOTE - HIGH BRIGHTNESS ILLUMINATION BASED ON LASER LIGHT DIFFUSION WITH MIE SCATTERING - CEREN CENGIZ 8:30AM-10:00AM **REGAL**

Chair: Jimil M. Shah - TMGcore, Inc.

Chair: Jason Valentine - Vanderbilt University

Chair: Anna Prakash - Intel

## High Brightness Illumination Based on Laser Light Diffusion with Mie Scattering

Technical Paper Publication: InterPACK2022-97220

Mohammad Azarifar - Ozyegin University, Ceren Cengiz - Ozyegin University, Kerem Ocaksönmez - Ozyegin University, Asim Onal - Koc University, Sedat Nizamoglu - Koc University, Mehmet Arik - Auburn University

## 08-01 MINI-SYMPOSIUM FOR PROFESSOR DASGUPTA I

10:15AM-11:45AM

**GRANADA**

Chair: Patrick McCluskey - University of Maryland, College Park

Chair: Pradeep Sharma - University of Houston

## Anisotropic Plastic Constitutive Properties of SAC305 Single Crystal Solder Joints

Technical Paper Publication: InterPACK2022-94505

Abhishek Deshpande - University of Maryland, Qian Jiang - University of Maryland, College Park, Abhijit Dasgupta - University of Maryland

## Multiaxial Interaction Between Printed Circuit Board Flexure and Quad Flat Package Interconnects Experiencing Plastic Strains

Technical Presentation Only: InterPACK2022-97479

Jonathan Kordell - Ansys, Abhijit Dasgupta - University of Maryland, Xiao Lin - University of Maryland

## Vibration Durability of Low-Profile Quad Flat Package (LQFP) Interconnects

Technical Presentation Only: InterPACK2022-94356

Xiao Lin - University of Maryland, College Park, Abhijit Dasgupta - University of Maryland, College Park

## 05-03 ADVANCED COOLING TECHNOLOGIES 2

10:15AM-11:45AM

**REGAL**

Chair: Joshua Major - National Renewable Energy Laboratory

## A Three-Face Utilized Heat Sink Design for 3-D Integrated 75 kVA Intelligent Power Stage (IPS)

Technical Paper Publication: InterPACK2022-97886

Abdul Basit Mirza - Stony Brook University, Xiaoqiang Xu - Stony Brook University, Asif Imran Emon - Stony Brook University, Fang Luo - Stony Brook University, Shikui Chen - Stony Brook University

## Dual Converging Jets for Enhanced Liquid Impingement Cooling

Technical Paper Publication: InterPACK2022-96635

Reece Whitt - University of Arkansas, Rafael Estrella - University of Arkansas, David Huitink - University of Arkansas



## Naturally Cooled Heat Sinks for Next-Generation Battery Chargers

Technical Paper Publication: InterPACK2022-98077

Callum Chhokar - Simon Fraser University, G. Bamorovat Abadi - Simon Fraser University, Nicholas Mcdaniel - Simon Fraser University, Chris Botting - Delta-Q Technologies, Majid Bahrami - Simon Fraser University

## Computational Models of Additive Manufactured Heat Spreading Device for Enhanced Localized Cooling

Technical Paper Publication: InterPACK2022-97446

Zion Clarke - Howard University, Sonya Smith - Howard University, Reece Whitt - University of Arkansas - Fayetteville, David Huitink - University of Arkansas-Fayetteville

## 02-05 HARDWARE COOLING I

10:15AM-11:45AM

VALENCIA

Chair: Cheng Chen - Facebook Inc.

Chair: Girish Anant Kini - AMD

## Liquid Cooling Practice on Meta's AI Training Platform

Technical Paper Publication: InterPACK2022-96972

Cheng Chen - Facebook Inc., Noman Mithani - Meta, Inc., Tiffany Jin - Meta, Inc., Allen Guo - CoolerMaster

## Determination of the Thermal Performance Limits for Single Phase Liquid Cooling Using an Improved Effectiveness-NTU Cold Plate Model

Technical Paper Publication: InterPACK2022-97421

Alfonso Ortega - Villanova University, Carol Caceres - Villanova University, Umut Uras - Villanova University, Deogratius Kisitu - Villanova University, Uschas Chowdhury - NVIDIA Corporation, Vahideh Radmard - NVIDIA Corporation, Ali Heydari - NVIDIA Corporation

## A Control Strategy for Minimizing Temperature Fluctuations in High Power Liquid to Liquid CDUs Operated at Very Low Heat Loads

Technical Paper Publication: InterPACK2022-97434

Ali Heydari - NVIDIA, Pardeep Shahi - The University of Texas Arlington, Vahideh Radmard - NVIDIA, Bahareh Eslami - NVIDIA, Uschas Chowdhury - NVIDIA, Chandraprakash Hinge - The University of Texas at Arlington, Lochan Cinthaparthi - The University of Texas at Arlington, Harold Miyamura - NVIDIA, Himanshu Modi - The University of Texas at Arlington, Dereje Agonafer - The University of Texas at Arlington, Jeremy Rodriguez - NVIDIA

## Transient CFD Analysis of Dynamic Liquid-Cooling Implementation at Rack Level

Technical Paper Publication: InterPACK2022-97443

Himanshu Modi - The University of Texas at Arlington, Pardeep Shahi - The University of Texas at Arlington, Akiilesh Sivakumar - The University of Texas at Arlington, Satyam Saini - The University of Texas at Arlington, Pratik Bansode - The University of Texas at Arlington, Vibin Shalom - The University of Texas at Arlington, Amrutha Valli Rachakonda - The University of Texas at Arlington, Gautam Gupta - The University of Texas at Arlington, Dereje Agonafer - The University of Texas at Arlington

## 06-04 THERMAL MANAGEMENT APPLICATIONS SECTION 1

10:15AM-11:45AM

MADRID

Chair: Aniket Ajay Lad - University of Illinois at Urbana-Champaign

Chair: Jorge Padilla - Google LLC

## Porous Diamond Surface for Enhanced Two-Phase Heat Transfer

Technical Presentation Only: InterPACK2022-97370

Yunseo Kim - Chung-Ang University

Daeyoung Kong - Chung-Ang University, Jungbae Lee - Chung-Ang University, Bongho Jang - Daegu Gyeongbuk Institute of Science and Technology, Hyuk-Jun Kwon - Daegu Gyeongbuk Institute of Science and Technology, Jung Bin In - Chung-Ang University, Hyoungsoon Lee - Chung-Ang University

## Melt Front Enhancement of Phase Change Materials via Nanoparticle Inclusion for Improved Heat Transfer and Cyclability

Technical Paper Publication: InterPACK2022-97399

Joshua Kasitz - University of Arkansas, Larry Marshall Jr. - University of Arkansas, David Huitink - University of Arkansas

# Technical Sessions

## The Microstructure-Thermal Property Relation of AlN and Al<sub>1-X</sub>Sc<sub>X</sub>C Thin Films for 5G Applications

Technical Presentation Only: InterPACK2022-97495

Yiwen Song - *The Pennsylvania State University*, Chi Zhang - *University of Minnesota*, James Spencer Lundh - *The Pennsylvania State University*, Hsien-Lien Huang - *The Ohio State University*, Yue Zheng - *Georgia Institute of Technology*, Timothy Mirabito - *The Pennsylvania State University*, Rossiny Beaucejour - *University of Pennsylvania*, Giovanni Esteves - *Sandia National Laboratories*, Craig Moe - *Akoustis*, Rytis Dargis - *IQE*, Jeremy Jones - *Nitride Global*, Jacob Leach - *Kyma Technologies*, Roy H. Olsson - *University of Pennsylvania*, Joan Redwing - *The Pennsylvania State University*, Azadeh Ansari - *Georgia Institute of Technology*, Jinwoo Hwang - *The Ohio State University*, Xiaojia Wang - *University of Minnesota*, Brian Foley - *The Pennsylvania State University*, Susan Trolier-Mckinstry - *The Pennsylvania State University*, Sukwon Choi - *The Pennsylvania State University*

## Direct Winding Cooling Solutions for High-Power Density Electric Vehicle Motors

Technical Presentation Only: InterPACK2022-97444

Amol Paranjape - *Georgia Institute of Technology*, Kevin Bennion - *National Renewable Energy Laboratory*, Emily Cousineau - *National Renewable Energy Laboratory*, Sreekant Narumanchi - *National Renewable Energy Laboratory*, Satish Kumar - *Georgia Institute of Technology*, Yogendra Joshi - *Georgia Institute of Technology*

## 4-01 MICRO-NANO SCALE APPLICATIONS IN ELECTRONICS

2:15PM-3:45PM

VALENCIA

Chair: Jason Valentine - *Vanderbilt University*

## Pool Boiling Heat Transfer in Dielectric Fluids and Impact of Surfaces on the Repeatability

Technical Paper Publication: InterPACK2022-97266

Tolga Emir - *Ozyegin University*, Yakup Gokalp Yazici - *Ozyegin University*, Mete Budakli - *Ozyegin University*, Mehmet Arik - *Auburn University*

## Experimental Investigation of R134a Flow Boiling in Copper Foam Evaporators for High Heat Flux Electronics Cooling

Technical Paper Publication: InterPACK2022-97400

Deogratus Kisitu - *Villanova University*, Carol Caceres - *Villanova University*, Metodi Zlatinov - *ERG Aerospace Corporation*, Denver Schaffarzick - *ERG Aerospace Corporation*, Alfonso Ortega - *Villanova University*

## Feasibility Demonstration of Server Chip Package with Direct-to-Chip Optical Transceivers

Technical Paper Publication: InterPACK2022-97455

Shidong Li - *IBM*, Bakul Parikh - *IBM*, Chelsea Savoy - *IBM*, Mark Kapfhammer - *IBM*, Daniel Kuchta - *IBM*, Guillaume Jutras - *IBM*, Harry Bagheri - *IBM*, Hilton Toy - *IBM*, Joe Ross - *IBM*, Ken-Ichi Akasofu - *IBM*, Mark Schultz - *IBM*, Steven Ostrander - *IBM*, Thomas Wassick - *IBM*

## Broadband Non-Volatile Electrically Controlled Programmable Units in Silicon Photonics Using GST

Technical Presentation Only: InterPACK2022-98820

Rui Chen - *University of Washington*, Zhuoran Fang - *University of Washington*, Jiajiu Zheng - *University of Washington*, Johannes Fröch - *University of Washington*, Peipeng Xu - *Ningbo University*, Arka Majumdar - *University of Washington*

## 01-02 HETEROGENEOUS INTEGRATION II

2:15PM-3:45PM

REGAL

Chair: Amanie Abdelmessih - *California Baptist University*

Chair: Hussameddine Kabani Kabani - *Facebook Inc.*

## Roadmap and Challenges on the Next Generation of Thermal Interface Material for High Warpage Heterogonies Package

Technical Presentation Only: InterPACK2022-97717

Gamal Refai-Ahmed - *Xilinx*

## Measurement of Effective Cure Shrinkage of Underfill Materials

Technical Presentation Only: InterPACK2022-97346

Changsu Kim - *University of Maryland*, Bongtae Han - *University of Maryland*

## Machine Learning and Simulation Based Temperature Prediction on High-Performance Processors

Technical Paper Publication: InterPACK2022-96751

Carlton Knox - *Boston University*, Zihao Yuan - *Boston University*, Ayse Coskun - *Boston University*

## 03-02 FLEXIBLE ELECTRONICS FOR WEARABLE APPLICATIONS

2:15PM-3:45PM MADRID

Chair: Sheng Xu - *University of California, San Diego*

Chair: Beth Paquette - *NASA*

### Smart Textiles for Personalized Health Care

Technical Presentation Only: InterPACK2022-98742

Jun Chen - *University of California, Los Angeles*

### A Breathable, Inflammation-Free, Biodegradable, Wearable Aerogel Electronic Skin for Multiplexed Chemical-Electrophysiological Analysis

Technical Presentation Only: InterPACK2022-98740

Yangzhi Zhu - *Terasaki Institute for Biomedical Innovation*

### Wearable Imaging of Deep-Tissue

Technical Presentation Only: InterPACK2022-98741

Hongjie Hu - *University of California, San Diego*, Yuxiang Ma - *University of California, San Diego*, Hao Huang - *University of California, San Diego*, Mohan Li - *University of California, San Diego*, Xiaoxiang Gao - *University of California, San Diego*, Sheng Xu - *University of California, San Diego*

### Characterization and Reliability Analysis of Direct Write Additively Printed Flexible Humidity Sensor with Super Capacitive Material for Wearable Astronaut Sensor in Harsh Environments

Technical Paper Publication: InterPACK2022-97432

Pradeep Lall - *Auburn University*, Hyesoo Jang - *Auburn University*, Curtis Hill - *NASA Marshall Space Flight Center*

## 08-02 MINI-SYMPOSIUM FOR PROFESSOR DASGUPTA II

2:15PM-3:45PM

GRANADA

Chair: Patrick McCluskey - *University of Maryland, College Park*

Chair: Pradeep Sharma - *University of Houston*

### Time-Scaling in Atomistics and Rate-Dependent Mechanical Behavior of Materials

Technical Presentation Only: InterPACK2022-89186

Pradeep Sharma - *University of Houston*

### Electro-Chemical Migration in Aerosol-Jet Printed Electronics Using Temperature-Humidity and Water Droplet Testing Methods

Technical Paper Publication: InterPACK2022-92306

Beihan Zhao - *University of Maryland, College Park*, Aniket Bharamgonda - *University of Maryland, College Park*, Eric Jennings - *University of Maryland, College Park*, Robert Utter - *University of Maryland, College Park*, Michael Osterman - *University of Maryland, College Park*, Michael Azarian - *University of Maryland, College Park*, Siddhartha Das - *University of Maryland, College Park*, Abhijit Dasgupta - *University of Maryland, College Park*, Jason Fleischer - *Laboratory for Physical Science*, Edwin Quinn - *Laboratory for Physical Sciences*, Daniel Hines - *Laboratory for Physical Sciences*

### Thermal Degradation of the Cu-Sn Imc System: Analysis and Simulations

Technical Presentation Only: InterPACK2022-97488

S.W. Ricky Lee - *The Hong Kong University of Science and Technology*, Jeffery C.C. Lo - *The Hong Kong University of Science and Technology*, Qiming Zhang - *Exponent*, Qian Jiang - *The Hong Kong University of Science and Technology*

### A Framework for Reliability Assessment of Chemical-Induced Display Delamination

Technical Presentation Only: InterPACK2022-98048

Joseph Varghese - *Google*, Kedar Hardikar - *Google*

# Technical Sessions

## 02-06 HARDWARE COOLING II

4:00PM–5:30PM

VALENCIA

Chair: Girish Anant Kini - AMD  
Chair: Pritish Parida - IBM Research

### Impact of Pressure Drop Oscillation Severity on Heat Transfer in Microchannel Flow Boiling

Technical Presentation Only: InterPACK2022-99136

Md. Emadur Rahman - Purdue University, Matthew Clark - Purdue University

### Compact and Highly Thermal-Hydraulic Efficient Air-Cooled Closed Loop Thermosyphon Cooling System for High Intense Heat Load Dissipation of Future Microprocessors

Technical Paper Publication: InterPACK2022-97364

Enzo Minazzo - JJ Cooling Innovation SÀRL, Gautier Rouaze - JJ Cooling Innovation SÀRL, Jackson Marcinichen - JJ Cooling Innovation SÀRL, John Thome - JJ Cooling Innovation SÀRL, Winston Zhang - Novark Technologies

### CFD Analysis of Heat Capture Ratio in a Hybrid Cooled Server

Technical Paper Publication: InterPACK2022-97445

Lochan Sai Reddy Chinthaparthi - The University of Texas at Arlington, Dereje Agonafer - The University of Texas at Arlington, Pardeep Shahi - The University of Texas at Arlington, Satyam Saini - The University of Texas at Arlington, Pratik Bansode - The University of Texas at Arlington, Vibin Simon - The University of Texas at Arlington, Himanshu Modi - The University of Texas at Arlington, Amrutha Valli Rachakonda - The University of Texas at Arlington

### Experimental Investigation of the Impact of Improved Ducting and Chassis Re-Design of a Hybrid-Cooled Server

Technical Paper Publication: InterPACK2022-97587

Himanshu Modi - The University of Texas at Arlington, Pardeep Shahi - The University of Texas at Arlington, Lochan Sai Reddy Chinthaparthi - The University of Texas at Arlington, Gautam Gupta - The University of Texas at Arlington, Pratik Bansode - The University of Texas at Arlington, Vibin Shalom - The University of Texas at Arlington, Dereje Agonafer - The University of Texas at Arlington

## 03-03 RELIABILITY OF FLEXIBLE ELECTRONICS

4:00PM–5:30PM

REGAL

Chair: Benjamin Leever - Air Force Research Laboratory  
Chair: Pradeep Lall - Auburn University

### Influence of Cure-Reflow Profile and High-Temperature Operation of Additively Printed Conductive Circuits on Performance and Reliability

Technical Paper Publication: InterPACK2022-97457

Pradeep Lall - Auburn University, Jinesh Narangaparambil - Auburn University, Curtis Hill - NASA Marshall Space Flight Center

### Evolution of Circuit Performance with Sustained 50°C Temperature Exposure for Additively Printed Inkjet Circuits with SMT Components

Technical Paper Publication: InterPACK2022-97430

Pradeep Lall - Auburn University, Kartik Goyal - Auburn University, Scott Miller - NextFlex

### Drop Durability of Printed Hybrid Electronic (PHE) Assemblies Under Extreme Acceleration Level

Technical Paper Publication: InterPACK2022-97382

Hisham Abusalma - University of Maryland, Abhijit Dasgupta - University of Maryland, Andres Bujanda - Army Research Laboratory, Jian Yu - Army Research Laboratory, Harvey Tsang - Army Research Laboratory

### Additive Manufacturing of Electronic Patterns for Harsh Environments

Technical Paper Publication: InterPACK2022-94052

Nicolas Delavault - CEA Tech Grand Est, Tanguy Lacondemine - CEA Tech Grand Est, Rémy Kalmar - CEA Tech Grand Est, Manuel Fendler - CEA Tech Grand Est, Sofiane Achache - Université de Technologie de Troyes, Frederic Sanchette - Université de Technologie de Troyes

## 08-06 THERMAL AND RELIABILITY

4:00PM–5:30PM

GRANADA

Chair: David Huitink - *University of Arkansas*

Chair: Alexander Otto - *Fraunhofer ENAS*

### Why “Beam Problems” Matter to Reliability Engineers

Technical Presentation Only: InterPACK2022-97350

Jingshi Meng - *Meta Platforms*

### Reliability Study on a SiC Power Module for Traction Application by Means of Power Cycling Tests and Coupled FE Analysis

Technical Presentation Only: InterPACK2022-99147

Alexander Otto - *Fraunhofer ENAS*, Rainer Dudek - *Fraunhofer ENAS*,

Sven Rzepka - *Fraunhofer ENAS*

### AI-Based Reliability Assessment of Power Electronic Systems

Technical Paper Publication: InterPACK2022-97614

Patrick McCluskey - *University of Maryland, College Park*, Clifton Buxbaum - *University of Maryland*, Sudip K. Mazumder - *University of Illinois Chicago*, Arif Sarwat - *Florida International University*, Matt Ursino - *Solectria*, Miles Russell - *Solectria*

### Impact of Immersion Cooling on Thermomechanical Properties of Non-Halogenated Substrate

Technical Paper Publication: InterPACK2022-97423

Rabin Bhandari - *The University of Texas at Arlington*, Akshay Boovanahally Lakshminarayana - *The University of Texas at Arlington*, Krishna Bhavana Sivaraju - *The University of Texas at Arlington*, Pratik Vithoba Bansode - *University of Texas at Arlington*, Ephrem Kejela - *The University of Texas at Arlington*, Dereje Agonafer - *The University of Texas at Arlington*

## 06-05 THERMAL MANAGEMENT APPLICATIONS 2

4:00PM–5:30PM

MADRID

Chair: Aalok Gaitonde - *Purdue University*

Chair: Jorge Padilla - *Google LLC*

### Effects of the Micro-Post Array on the Operating Limit of a Micro Pulsating Heat Pipe

Technical Presentation Only: InterPACK2022-97289

Young Jong Lee - *Korea Advanced Institute of Science and Technology*,

Sung Jin Kim - *Korea Advanced Institute of Science and Technology*

### Additively Manufactured Liquid-Cooled Heat Sink: Gyroid-Based Design, Fabrication, and Testing

Technical Paper Publication: InterPACK2022-97476

Adrian Jourdan - *University of North Texas*, Alexander Sarvadi - *University of North Texas*, Hector R. Siller - *University of North Texas*, Huseyin Bostanci - *University of North Texas*

### Power Envelope Analysis for the Thermal Optimization of a Chiplet Module

Technical Paper Publication: InterPACK2022-97204

Eric Ouyang - *JCET Group*, Xiao Gu - *JCET Group*, Yonghyuk Jeong - *JCET Group*, Michael Liu - *JCET Group*

### Topology Optimization of Heat Sink for 3D Integrated Power Converters

Technical Paper Publication: InterPACK2022-98066

Xiaoqiang Xu - *Stony Brook University*, Abdul Basit Mirza - *Stony Brook University*, Lingfeng Gao - *Stony Brook University*, Fang Luo - *Stony Brook University*, Shikui Chen - *Stony Brook University*

# Technical Sessions

## THURSDAY, OCTOBER 27, 2022

### TRACK 1 KEYNOTE- WINING ROAD TO MAXIMIZE SYSTEM PERFORMANCE - GAMAL REFAI-AHMED 8:30AM-10:00AM

REGAL

Chair: Anna Prakash - Intel

Chair: Amanie Abdelmessih - California Baptist University

Chair: Gamal Refai-Ahmed - AMD Inc.

Chair: Jimil M. Shah - TMGcore, Inc.

### Roadmap and Challenges on the Next Generation of Thermal Interface Material for High Warpige Heterogonies Package

Technical Presentation Only: InterPACK2022-97718

Gamal Refai-Ahmed - Xilinx

### 09-01 DIGITAL TECHNOLOGIES IN MICROELECTRONICS 2:15PM-3:45PM

REGAL

Chair: Joyce Weiner - Intel

Chair: Azeem Sarwar - GM

### Visual Analytics for Systems Engineering on Complex Automotive Systems

Technical Presentation Only: InterPACK2022-99155

Ahsan Qamar - Ford

### AI/ML Applications for Thermally Aware SoC Designs

Technical Paper Publication: InterPACK2022-97186

Adam Norman - Intel, Mark Gallina - Intel, Olena Zhu - Intel, Joyce Weiner - Intel, Fabian Garita Gonzalez - Intel

### ESG Data Pipeline

Technical Presentation Only: InterPACK2022-99304

Usman Syed - Bloomberg L.P.

### 05-04 PHASE CHANGE COOLING TECHNOLOGIES

10:15AM-11:45AM

REGAL

Chair: Huseyin Bostanci - University of North Texas

Chair: Hyoungsoon Lee - Chung-Ang University

### The Boiling-Driven Heat Spreader Embedded Device for Thermal Management in High-Power Semiconductor

Technical Presentation Only: InterPACK2022-97486

Jungho Lee - Ajou University, Hyunmuk Lim - Ajou University, Su-Yoon Doh - Ajou University, Seung Mun You - The University of Texas at Dallas

### Measurements and Parametric Study of Phase Change Material Integrated Transient Cooling

Technical Presentation Only: InterPACK2022-94910

Soonwook Kim - University of Illinois at Urbana-Champaign, Tianyu Yang - Northwestern University, Nenad Miljkovic - University of Illinois at Urbana-Champaign, William King - University of Illinois at Urbana-Champaign

### Dielectric Liquid Thermal Management for Near-Junction Wide-Bandgap Power Electronics Cooling

Technical Presentation Only: InterPACK2022-97459

Akshith Narayanan - Georgia Institute of Technology, Justin Broughton - Georgia Institute of Technology, Gilbert Moreno - National Renewable Energy Laboratory, Sreekant Narumanchi - National Renewable Energy Laboratory, Yogendra Joshi - Georgia Institute of Technology

### Performance Validation of Voltage Blocking Technologies for Direct Cooling of High-Density Power Electronics

Technical Paper Publication: InterPACK2022-97412

Ange Christian Iradukunda - University of Arkansas, David Huitink - University of Arkansas, Tarek Gebrael - University of Illinois at Urbana-Champaign, Nenad Miljkovic - University of Illinois at Urbana-Champaign

## 03-04 FLEXIBLE POWER DEVICES

10:15AM–11:45AM

MADRID

Chair: Sheng Xu - *University of California, San Diego*  
Chair: Benjamin Leever - *Air Force Research Laboratory*

### Electric Double-Layer Capacitors with High Areal and Volumetric Capacitance and Rapid Frequency Response for Miniaturizing Filter and Power Devices

Panel: InterPACK2022-100367

Binggong Wei - *University of Delaware*, Guowen Meng - *Chinese Academy of Sciences*, Fangming Han - *Chinese Academy of Sciences*

### SOH Degradation Estimation of Thin Flexible Li-Ion Power Sources Subjected to Accelerated Life Cycling with Randomized Charge-Discharge and C-Rates

Technical Paper Publication: InterPACK2022-97451

Pradeep Lall - *Auburn University*, Ved Soni - *Auburn University*

### Additively Printed Flexible Charging Circuits and Effect on Evolution of Line Resistance and Charging Current in Charging Thin Flexible Batteries

Technical Paper Publication: InterPACK2022-97450

Pradeep Lall - *Auburn University*, Ved Soni - *Auburn University*, Scott Miller - *NextFlex*

### ANN Based Assessment of State-of-Health Reliability of Flexible Li-Ion Batteries Under Dynamic Flexing and Calendar Aging

Technical Paper Publication: InterPACK2022-97431

Pradeep Lall - *Auburn University*, Hyesoo Jang - *Auburn University*

## 06-06 THERMAL MATERIALS

10:15AM–11:45AM

VALENCIA

Chair: Ashutosh Giri - *University of Rhode Island*  
Chair: Brian Donovan - *United States Naval Academy*

### Independent Microscale Sensing of Moving Phase Interface Behavior and Local Surface Temperature During Sessile Water Droplet Evaporation from a Heated Surface

Technical Presentation Only: InterPACK2022-93914

Md. Tanbin Hasan Mondal - *Louisiana Tech University*, Rifat-E-Nur Hossain - *Louisiana Tech University*, Ronald Martin - *Louisiana Tech University*, Arden L. Moore - *Louisiana Tech University*

### The Effect of Surface Wettability on Microdroplet Contact Line Profile and Evaporation Rate on Non-Axisymmetric Micropillars

Technical Presentation Only: InterPACK2022-97426

Yousof Nayfeh - *Washington University in St. Louis*, Kidus Guye - *Washington University in St. Louis*, Vivek V. Manepalli - *Washington University in St. Louis*, Erdong Song - *Washington University in St. Louis*, Damena Agonafer - *Washington University in St. Louis*

### The High Thermal Conductivity and Negligible Contact Resistance of Skin Softening Thermal Interface Materials

Technical Presentation Only: InterPACK2022-98858

Taehun Kim - *Sungkyunkwan University*, Seongkyun Kim - *Sungkyunkwan University*, Eungchul Kim - *Sungkyunkwan University*, Taesung Kim - *Sungkyunkwan University*, Jungwan Cho - *Sungkyunkwan University*, Changsik Song - *Sungkyunkwan University*, Seunghyun Baik - *Sungkyunkwan University*

### Anisotropic Thermal Property Characterization Using Infrared Imaging

Technical Presentation Only: InterPACK2022-99163

Aalok Gaitonde - *Purdue University*, Aaditya Candadai - *Purdue University*, Justin Weibel - *Purdue University*, Amy Marconnet - *Purdue University*

# Technical Sessions

## 02-07 HARDWARE COOLING III

2:15PM-3:45PM

VALENCIA

Chair: Jiu Xu - Facebook Inc.

Chair: Jayati Athavale - Facebook Inc.

### Dual-Evaporator Thermosyphon Cooling System for Electronics Cooling

Technical Paper Publication: InterPACK2022-97729

Raffaele Luca Amalfi - Segunte, LLC, Filippo Cataldo - Nokia Bell Labs

### Topology Optimization for Additively Manufactured Microchannel Heat Sinks

Technical Presentation Only: InterPACK2022-99144

Serdar Ozguc - Purdue University, Liang Pan - Purdue University

### Experimental Study of Transient Hydraulic Characteristics for Liquid Cooled Data Center Deployment

Technical Paper Publication: InterPACK2022-97425

Ali Heydari - NVIDIA, Pardeep Shahi - The University of Texas at Arlington, Vahideh Radmard - NVIDIA, Bahareh Eslami - NVIDIA, Uschas Chowdhury - NVIDIA, Akiilesh Sivakumar - The University of Texas at Arlington, Akshay Lakshminarayana - The University of Texas at Arlington, Harold Miyamura - NVIDIA, Gautam Gupta - The University of Texas at Arlington, Dereje Agonafer - The University of Texas at Arlington, Jeremy Rodriguez - NVIDIA

### Comparative Study of Single-Phase Immersion Cooled Two Socket Server in Tank and Sled Configurations

Technical Paper Publication: InterPACK2022-97429

Krishna Bhavana Sivaraju - The University of Texas at Arlington, Pratik Bansode - The University of Texas at Arlington, Gautam Gupta - The University of Texas at Arlington, Jacob Lamotte-Dawaghreh - The University of Texas at Arlington, Satyam Saini - The University of Texas at Arlington, Vibin Simon - The University of Texas at Arlington, Joseph Herring - The University of Texas at Arlington, Saket Karajgikar - Meta, Veerendra Mulay - Meta, Dereje Agonafer - The University of Texas at Arlington

## 03-05 FLEXIBLE ELECTRONICS PROCESSING

2:15PM-3:45PM

MADRID

Chair: Mary Herndon - Raytheon

### Length-Scale Effects in Average Viscoplastic Behavior of Sintered Silver Materials: Empirical Exploration with Indentation Methods

Technical Paper Publication: InterPACK2022-97363

David Leslie - University of Maryland, College Park, Dasgupta Abhijit - University of Maryland, College Park, Andrei Damian - NXP Semiconductors Netherlands B.V.

### Mechanical and Electrical Properties of Additively Printed Circuits with Magnetically Orientated Anisotropic Conductive Adhesive Attachment for FHE Applications

Technical Paper Publication: InterPACK2022-97456

Pradeep Lall - Auburn University, Jinesh Narangaparambil - Auburn University, Scott Miller - NextFlex

### Deep Learning for Prediction of Print Parameters and Realized Electrical Performance and Geometry on Inkjet Platform

Technical Paper Publication: InterPACK2022-97437

Pradeep Lall - Auburn University, Shriram Kulkarni - Auburn University, Scott Miller - NextFlex, Kartik Goyal - Auburn University, Ved Soni - Auburn University

### Predictive Methods for Electrical and Mechanical Process-Output for Inkjet Additive Printed Circuits

Technical Paper Publication: InterPACK2022-97428

Pradeep Lall - Auburn University, Kartik Goyal - Auburn University, Scott Miller - NextFlex



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## 08-07 HIGH TEMPERATURE OPERATION

2:15PM-3:45PM

GRANADA

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Chair: Patrick McCluskey - *University of Maryland, College Park*

Chair: David Huitink - *University of Arkansas*

### **Predictive Cohesive Zone Modeling for Delamination at PCB-Potting Material Interfaces Under Four-Point Bend Loading with Sustained High-Temperature Exposure**

Technical Paper Publication: InterPACK2022-97427

Pradeep Lall - *Auburn University*, Aathi Pandurangan - *Auburn University*, Ken Blecker - *U.S. Army Combat Capabilities Development Command - Armament Center*

### **Modeling Underfill Degradation and Its Effect on FCBGA Package Reliability Under High Temperature Operation**

Technical Paper Publication: InterPACK2022-97433

Pradeep Lall - *Auburn University*, Madhu Kasturi - *Auburn University*, Haotian Wu - *Auburn University*, Edward Davis - *Auburn University*

### **Evolution of the Interface Critical Stress Intensity Factors Between TIM Copper Substrates due to High-Temperature Isothermal Aging**

Technical Paper Publication: InterPACK2022-97440

Pradeep Lall - *Auburn University*, Padmanava Choudhury - *Auburn University*, Jaimal Williamson - *Texas Instruments*

### **Characterization of Fatigue Crack Growth of Epoxy Molding Compounds Under High Temperature Long Term Aging**

Technical Paper Publication: InterPACK2022-97453

Pradeep Lall - *Auburn University*, Yunli Zhang - *Auburn University*, Jeff Suhling - *Auburn University*, Jaimal Williamson - *Texas Instruments*, Pat Thompson - *Texas Instruments*



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## WOMEN ENGINEERING AWARD



**Professor Amanie N. Abdelmessih**  
*California Baptist University*  
*Riverside, CA*

Dr. Amanie Abdelmessih, ASME Fellow, Professor of Mechanical Engineering; California Baptist University: She started her career in industry, then joined academia. She taught 16 years at Saint Martin's University where she founded and was the director of the Thermal Engineering Laboratory. In addition, she started the Master of Mechanical Engineering program fall 2012. Then, she moved to California Baptist University.

During Dr. Abdelmessih's career, she has taught over 20 different undergraduate and graduate courses mostly in the thermal science / engineering area. She created and taught courses such as Computational Heat Transfer & Thermal Modeling, Solar Thermal Engineering, Heat Transfer in Electronics and Micro-electronic Packaging, Energy Systems, HVAC, and Thermal Design of Heat Exchangers. Consistently, she has been teaching Heat Transfer and Capstone Design.

Dr. Abdelmessih has performed research in different topics including high temperature calibrations, developed a natural/forced laminar internal flow correlation, and miniature HVAC from bench top apparatus to wearable ones, using different technologies from vapor compression, to absorption, to Peltier. What is unique is 50 undergraduate students co-authored refereed articles with her.

Numerous summers Dr. Abdelmessih performed research at NASA Armstrong (Dryden) and Marshall Space Flight Research Centers, Argonne National Laboratory, and Pacific Northwest National Laboratory, receiving five certificates of recognition for her research contributions at NASA. She received the 2001 Outstanding Faculty Award from the Monks of Saint Martin's Abbey, the 2005 Academic Engineer of the Year from Puget Sound Engineering Council, WA, and the 2009 Distinguished Engineering Educator from the National SWE, in addition to numerous other recognitions.

Dr. Abdelmessih is an ASME Fellow, a senior member of AIChE and SWE, and a member of ASHRAE and ASEE. the Society of Fellows, Omega Chi Epsilon, and Pi Tau Sigma. She was the founding advisor for CBU SWE Collegiate section. She is nationally and internationally active with ASME. Since 2003, she has frequently led as track organizer for K-16 at the Heat Transfer Conferences, InterPACK, IMECE, and international conferences. She reviews numerous articles for refereed Journals and Conferences. She has served as panelist for NSF, DoD, SMART, NDSEG, and AFRL-SFFP.

## EARLY CAREER ENGINEER AWARD



**Professor Ronald J. Warzoha**  
*Johns Hopkins University*  
*Baltimore, MD*

Ron Warzoha is currently a Sr. Research Scientist at the Johns Hopkins University Applied Physics Laboratory. Previously, Dr. Warzoha spent 8 years as an Associate Professor and Assistant Professor of Mechanical Engineering at the United States Naval Academy. He is a graduate of Villanova University ('14, '09, '08), where he worked under the tutelage of Dr. Amy Fleischer. Dr. Warzoha has expertise is in the areas of electronics thermal management, thermal energy storage, and nanoscale/microscale heat transfer in solid-state materials. He is a member of the K-16 committee, where he founded the K-16 mentorship workshop and co-runs the ASME K-16 Student Heat Sink Design Competition. Dr. Warzoha has over 40 peer-reviewed publications in journal and conference proceedings, holds one patent, and has been recognized as one of USNA's best teaching faculty after receiving the Apgar Award for Teaching Excellence.

## JEP BEST AE OF THE YEAR AWARD

Ronald Warzoha for his outstanding leadership and contribution to the Special Issue of "A Tribute to Prof. Avram Bar-Cohen"

## JEP BEST PAPER OF THE YEAR AWARD

Title: Prognostics and Health Management Features for Large Circuit Boards to Be Implemented into Electric Drivetrain Applications

Authors:

A. Otto, E. Kaulfersch, P. Singh, C. Romano, M. Hildebrandt, S. Rzepka

## K-16 EARLY CAREER FACULTY AWARD



**Professor Damena Agonafer**  
University of Maryland  
College Park, MD

Dr. Agonafer is an Associate Professor & Clark Faculty Fellow at The University of Maryland, College Park. Professor Agonafer earned his PhD at the University of Illinois Urbana-Champaign, where he was supported by Alfred P. Sloan fellowship, Graduate Engineering Minority Fellowship, and NSF Center of Advanced Materials for Purification of Water with Systems (WaterCAMPWS). After his PhD, Damena joined Professor Ken Goodson's Nanoheat lab as a Postdoctoral Scholar in the Mechanical Engineering Department at Stanford University. Prior to joining University of Maryland, Damena was an Assistant Professor in the Department of Mechanical Engineering at Washington University in Saint Louis. He is a recipient of the Google Research Award, Sloan Research Fellowship Award, Cisco Research Award, NSF CAREER Award, and American Society of Mechanical Engineer's Early Career award. He was also one of 85 early-career engineers in the US selected to attend the 2021 National Academy of Engineering's 26th annual US Frontiers of Engineering symposium. He is focused on developing novel materials and systems for thermal management of power and microelectronic systems, as well as for thermochemical and electrochemical energy storage applications. His goal is to achieve transformational changes in technologies by tuning and controlling solid-liquid-vapor interactions at micro-/nano length scales. Specific areas of focus include the development of novel materials and micro-/nanostructures for phase change heat transfer, thermochemical energy storage, and interfacial transport phenomena. Applications of his work include cooling high-powered electronics, battery thermal management, and data center cooling, and improving the efficiency of HVAC systems.

## K-16 BEST GRADUATE STUDENT PAPER AWARD



**Qianying Wu**  
Stanford University  
Stanford, CA

Qianying Wu is a 5th-year PhD candidate and TomKat Graduate Fellow in Mechanical Engineering at Stanford advised by Prof. Ken Goodson and was a research intern at Nokia Bell Labs mentored by Dr. Todd Salamon. Her PhD research are on capillary-driven liquid-vapor phase change, modeling of maldistribution in two-phase cooling devices, and the integration of efficient thermal management technologies for positive energy and sustainability impact. Qianying received B.S in Engineering and B. Econ from Tsinghua University and is a recipient of Prof. Avram Bar-Cohen Best Paper Award from iTherm, and Top 10 Best Student Presentation Award from SRC.

## AVRAM BAR-COHEN MEDAL AWARD



**Professor Pradeep Lall**  
MacFarlane Endowed Distinguished Professor and  
Director  
Auburn University  
Auburn, AL

Pradeep Lall is the MacFarlane Endowed Distinguished Professor with the Department of Mechanical Engineering and Director of the NSF-CAVE3 Electronics Research Center at Auburn University. He holds Joint Courtesy Appointments in the Department of Electrical and Computer Engineering and the Department of Finance. He is a member of the technical council and academic co-lead of automotive and asset monitoring TWGs of NextFlex Manufacturing Institute. He is the author and co-author of 2-books, 15 book chapters, and over 800 journal and conference papers in the field of electronics reliability, manufacturing, safety, test, energy efficiency, and survivability. Dr. Lall is a fellow of the ASME, a fellow of the IEEE, a fellow of the NextFlex National Manufacturing Institute, and a fellow of the Alabama Academy of Science. He is recipient of the IEEE Biedenbach Outstanding Engineering Educator Award, Auburn University Research Advisory Board's Advancement of Research and Scholarship Achievement Award, IEEE Sustained Outstanding Technical Contributions Award, NSF-IUCRC Association's Alex Schwarzkopf Award, Alabama Academy of Science Wright A, Gardner Award, IEEE Exceptional Technical Achievement Award, ASME-EPPD Applied Mechanics Award, SMTA's Member of Technical Distinction Award, Auburn University's Creative Research and Scholarship Award, SEC Faculty Achievement Award, Samuel Ginn College of Engineering Senior Faculty Research Award, Three-Motorola Outstanding Innovation Awards, Five-Motorola Engineering Awards, and over Fifty Best-Paper Awards at national and international conferences. Dr. Lall has served in several distinguished roles at national and international level including serving as member of National Academies Committee on Electronic Vehicle Controls, Member of the IEEE Reliability Society AdCom, IEEE Reliability Society Representative on the IEEE-USA Government Relations Council for R&D Policy, Chair of Congress Steering Committee for the ASME Congress, Member of the technical committee of the European Simulation Conference EuroSIME, Associate Editor for the IEEE Access Journal, and Associate Editor for the IEEE Transactions on Components and Packaging Technologies. Dr. Lall is the founding faculty advisor for the SMTA student chapter at Auburn University and member of the editorial advisory board for SMTA Journal. He received the M.S. and Ph.D. degrees in Mechanical Engineering from the University of Maryland and the M.B.A. from the Kellogg School of Management at Northwestern University.

## ALAN KLAUS MEDAL AWARD



**Professor Samuel Graham**  
*University of Maryland*  
*College Park, MD*

Dr. Samuel Graham, Jr. is the Dean of the Clark School of Engineering at the University of Maryland, taking on this role in 2021. Prior to taking this role, he served as the Chair of the Woodruff School of Mechanical at the Georgia Institute of Technology. He also holds a joint appointment with the National Renewable Energy Laboratory.

His current research centers on the development of electronics made from wide bandgap semiconductors (III-V, oxides) for a range of applications including displays, rf communications, power switches, and neuromorphic computing. His research on wide bandgap semiconductors is focused on engineering the thermal response of the devices in order to enhance heat dissipation and improve device reliability. A key aspect of this work is in developing the understanding to engineer interfaces within the devices to enhance thermal transport. For neuromorphic devices, he is creating physics-based models and experimental tools to design the electro-thermal-ion transport response in neuromorphic computing systems. He also has ongoing work to design new materials to increase the mechanical reliability in flexible electronics for energy harvesting or wearable applications.

From 1999 to 2003, Dr. Graham was a Sr. Member of Technical Staff at Sandia National Laboratory in Livermore, CA where he worked on the development of optical coatings for EUV lithography systems. In 2003, he joined the Woodruff school of Mechanical Engineering at the Georgia Institute of Technology as an Assistant Professor. He was promoted to Professor in 2013 and then the Eugene C. Gwaltney, Jr. Professor and School chair in 2018.

Dr. Graham was a member of the Defense Science Study Group (2014-16) and a member of the Air Force Scientific Advisory Board (2016-2020). He presently serves on the Advisory Board of the Engineering Science Research Foundation of Sandia National Laboratory and the Emerging Technologies Technical Advisory Committee of the US Department of Commerce. He is a Fellow of ASME and a Sr. Member of IEEE.

## INTEL BEST PAPER AWARD

To Be Announced at the Conference

## BEST PAPER AWARD

To Be Announced at the Conference

## BEST POSTER PAPER

To Be Announced at the Conference

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		Track Co-Chair	Amenie Abdelmessih
		Track Co-Chair	Jacek Nazdrowicz
		Track Co-Chair	Jin Yang
		Track Co-Chair	Tim Chainer
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		Track Co-Chair	Pritish Parida
3	Flexible, Wearable and Additively Printed Electronics	Track Chair	Benjamin Leever
		Track Co-Chair	Pradeep Lall
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		Track Co-Chair	Bo Zhao
		Track Co-Chair	Jason Valentine
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		Track Co-Chair	Jorge Padilla
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		Track Co-Chair	Nenad Milkovic

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		Track Co-Chair	Baris Dogruoz
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8	Reliability of Electronic Packages and Systems	Track Chair	Patrick McCluskey
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		Track Co-Chair	Taimoor Khawaja
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		Track Chair (Panel)	Victor Chiriac



Topic/Session	Topic/Session Primary Chair Last Name	Topic/Session Primary Chair First Name	Topic/Session Primary Chair Affiliation
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08-02 Mini-Symposium for Professor Dasgupta II	McCluskey	Patrick	University of Maryland, College Park
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# Session Organizers

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Manager, Events Management

**Josalind Mercado**  
*Meetings Coordinator, Events Management*

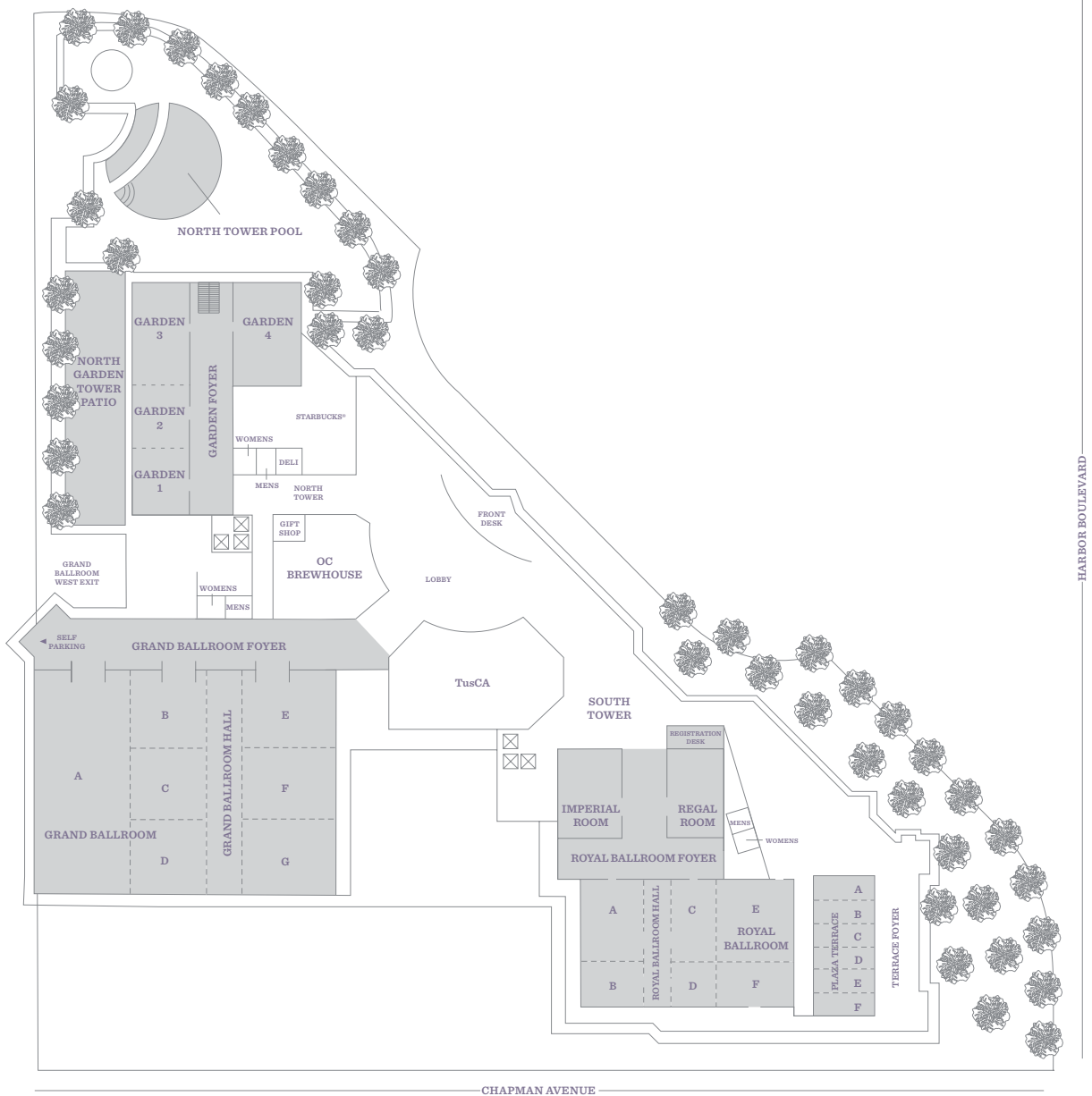
**Laraine Lee**  
*Specialist, Conference E-Tools*

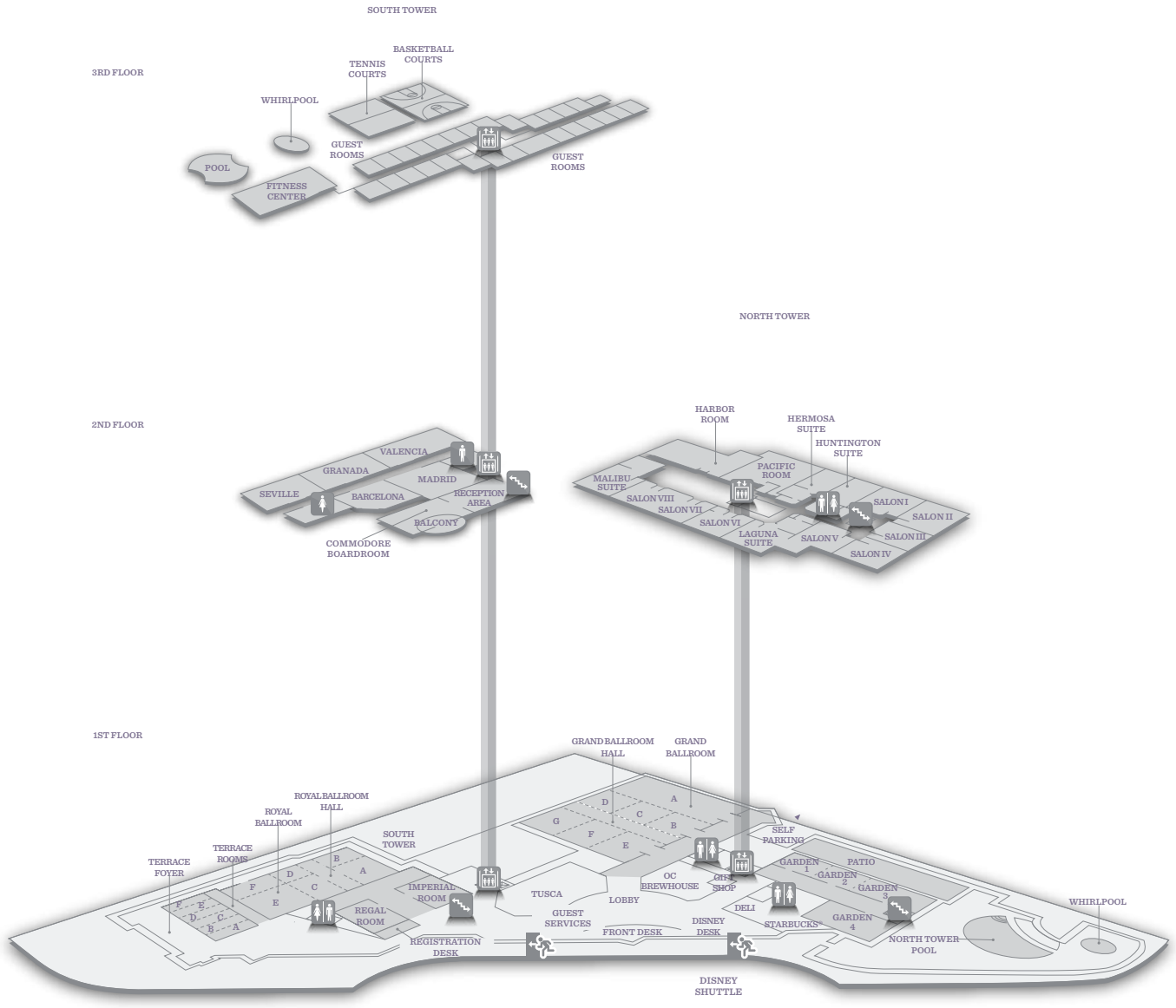
**Barbara Zlatnik**  
*Sr. Manager, Tech & Engineering Communities  
Houston Office*

**Mary Grace Stefanchik**  
*Director, Publishing Development*

**Mary Rose MacDonald**  
*Publishing Coordinator, Conf. Publications*

**Amber Grady-Fuller**  
*Copyright & Proceeding Coordinator*





Thank you for  
joining us!

See you in 2023!