



2024
International Conference on
Compound Semiconductor
Manufacturing Technology

May 20th – 23rd, 2024
www.csmantech.org

JW Marriott Starr Pass Resort
Tucson, Arizona, USA

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CONFERENCE AT A GLANCE

SUNDAY, May 19th

6:00 PM – 8:00 PM **REGISTRATION**
Arizona Registration Desk

MONDAY, May 20th

7:00 AM – 7:00 PM **REGISTRATION**
Arizona Registration Desk

7:00 AM – 8:00 AM **BREAKFAST**
Ania Terrace

7:50 AM – 5:40 PM **CS MANTECH WORKSHOP**
Tucson Ballroom E

8:00 AM – 5:00 PM **ROCS WORKSHOP**
Tucson Ballroom F

12:20 PM – 1:20 PM **LUNCHEON FOR WORK-
SHOPS**
Salons A-D

6:00 PM – 9:00 PM **EXHIBITOR RECEPTION**
Arizona Ballroom

TUESDAY, May 21st

7:00 AM – 8:30 AM **BREAKFAST**
Arizona Ballroom

8:00 AM – 5:00 PM **EXHIBIT HOURS**
Arizona Ballroom

8:00 AM – 8:15 AM **OPENING CEREMONIES**
Tucson Ballroom F

8:15 AM – 09:45 AM **SESSION 1.0:
OPTOELECTRONICS
PLENARY**
Tucson Ballroom E & F

09:45 AM – 10:30 AM **BREAK**

10:30 AM – 12:10 PM **SESSION 2.1: POWER I**
Tucson Ballroom E

10:30 AM – 12:10 PM **SESSION 2.2: RF DEVICES I**
Tucson Ballroom F

12:10 PM – 1:15 PM **EXHIBITS LUNCH**
Arizona Ballroom

12:20 PM – 1:10 PM **EXHIBITOR FORUM**
Tucson Ballroom B, C, D

1:15 PM – 2:45 PM **SESSION 3.1: ADVANCED
WAFER PROCESSING**
Tucson Ballroom E

1:15 PM – 2:45 PM **SESSION 3.2: RF DEVICES
II**
Tucson Ballroom F

2:45 PM – 3:20 PM **BREAK**

3:20 PM – 5:00 PM **SESSION 4.1: POWER II**
Tucson Ballroom E

3:20 PM – 5:00 PM **SESSION 4.2: CS AND SI
INTEGRATION**
Tucson Ballroom F

5:15 PM – 6:15 PM **STUDENT FORUM**
Tucson Ballroom J

5:15 PM – 6:10 PM **EXHIBITOR FORUM**
Tucson Ballroom B, C, D

6:15 AM – 6:30 PM **BUSES DEPART FOR IN-
TERNATIONAL
RECEPTION**
Bus Departure Area

7:00 AM – 10:00 PM **INTERNATIONAL
RECEPTION**
Culinary Dropout, Tucson!

WEDNESDAY, May 22nd

7:00 AM – 8:30 AM **BREAKFAST**
Arizona Ballroom

8:00 AM – 11:00 AM **EXHIBIT HOURS**
Arizona Ballroom

8:00 AM – 9:45 AM **SESSION 5.0: POWER
PLENARY**
Tucson Ballroom E & F

9:45 AM – 10:30 AM **BREAK**

10:30 AM – 12:10 PM **SESSION 6.1: POWER III**
Tucson Ballroom F

10:30 AM – 12:10 PM **SESSION 6.2: OPTOELEC-
TRONIC MANUFACTUR-
ING**
Tucson Ballroom E

12:10 PM – 1:30 PM **LUNCH BREAK**

1:30 PM – 3:00 PM **SESSION 7.1: HETEROGENEOUS INTEGRATION**
Tucson Ballroom F

1:30 PM – 3:10 PM **SESSION 7.2: OPTOELECTRONIC DEVICES**
Tucson Ballroom E

3:10 PM – 3:30 PM **BREAK**

3:30 PM – 5:00 PM **SESSION 8.1: GAN RF DEVICES AND CIRCUITS**
Tucson Ballroom F

3:30 PM – 5:00 PM **SESSION 8.2: VCSELS**
Tucson Ballroom E

THURSDAY, May 23rd

7:15 AM – 8:15 AM **BREAKFAST**
Tucson Ballrooms

8:15 AM – 9:45 AM **SESSION 9.0: CHIPS AND RF PLENARY**
Tucson Ballroom E & F

9:45 AM – 10:15 AM **BREAK**

10:15 AM – 11:55 AM **SESSION 10.1: EPITAXY AND MATERIALS**
Tucson Ballroom E

10:15 AM – 11:55 AM **SESSION 10.2: INDUSTRY AND AI**
Tucson Ballroom F

11:55 PM – 1:00 PM **CS MANTECH LUNCHEON**

1:00 PM – 2:40 PM **SESSION 11.1: METALLIZATION AND LITHO**
Tucson Ballroom E

1:00 PM – 2:40 PM **SESSION 11.2: CHARACTERIZATION**
Tucson Ballroom F

2:40 PM – 3:40 PM **POSTER SESSION**
Arizona Ballroom

3:40 PM – 4:30 PM **CLOSING RECEPTION AND RICHARD GOTTSCHO CAPSTONE**
Arizona Ballroom

MESSAGE FROM THE CONFERENCE CHAIR

On behalf of the Executive and Technical Program Committees, it is my pleasure to extend a warm welcome to you for the 38th International Conference on Compound Semiconductor Manufacturing Technology (CS MANTECH) in Tucson, Arizona.

Since its inception in 1986, CS MANTECH has been a steadfast supporter and promoter of the compound semiconductor industry. Each year, our conference offers a platform for technical presentations, vendor exhibits, and invaluable networking opportunities, bringing together professionals from industry, academia, and government organizations. Through these interactions and information exchanges, we strive to propel the compound semiconductor industry forward. This year's event promises a wealth of outstanding presentations covering key CS MANTECH topics such as markets and applications, RF devices, power devices, photonics technology, process development and control, materials, manufacturing, test, and device reliability. With over 85 presentations and posters lined up, there's something of interest for every attendee.

During abstract submission or online registration this year, you may have noticed that CS MANTECH is in the process of migrating our electronic systems to a new platform. This transition has certainly been a learning experience for us, and we sincerely appreciate everyone's patience and understanding as we navigate through the development of these new systems. Our primary objective is to offer you straightforward, modern interfaces that enhance your conference experience by providing the necessary information efficiently. We encourage you to share any suggestions you may have in the conference survey – your feedback is important, and we are committed to incorporating constructive input to continually improve.

The success of this conference hinges on the dedication and commitment of numerous volunteers who comprise the technical program and executive committees. I extend my heartfelt appreciation and gratitude to these individuals, as well as to the companies, institutions, and organizations that support them. Without their collective efforts, this conference would not be possible.

Welcome to Tucson and to CS MANTECH 2024!

David Meyer
Naval Research Laboratory
2024 CS MANTECH Conference Chair

2024 CONFERENCE SPONSORS

CS MANTECH is an independent not-for-profit organization whose mission is to promote technical discussion and scientific education in the compound semiconductor manufacturing industry. The continued success of the conference is enabled by donations from corporate sponsors. The 2024 CS MANTECH Conference Committee gratefully acknowledges the support from our sponsors.

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2024 CONFERENCE HIGHLIGHTS

Welcome to the 2024 Compound Semiconductor Manufacturing Technology International Conference! Our Executive and Technical Program Committees have done an outstanding job of soliciting and organizing a program that matches the amazing setting we have here at the JW Marriott Starr Pass in Tucson, Arizona. I know you will enjoy the oral and poster presentations, and I'm confident you will also leave the conference with more than you came with: A better technical understanding of key concepts that will directly impact your work, and more customer/supplier/collaborator contacts. I'm also confident that you will have a great time while gaining those concepts and contacts. Let me take a moment to describe what is in store for us for this week's conference program.

The CS MANTECH workshop kicks off the week on Monday, May 20th. The theme for this year's workshop is "AI/ML Tools and Opportunities for CS Manufacturing." If you are curious about how AI/ML will impact our industry, or if you are deeply involved in the early stages of this hot topic, you will want to be a part of this workshop discussion. In parallel, the Reliability of Compound Semiconductors (ROCS) workshop will join our conference again for attendees to discuss the latest in CS reliability and how to overcome those barriers for wider technology adoption and application. After Monday's workshops, the Exhibitor Reception welcomes you to our annual Exhibition in the Arizona Ballroom. This is your first opportunity to interact with other CS MANTECH attendees, including your customers, suppliers, and collaborators, over a great selection of local snacks and drinks.

The CS MANTECH Conference begins on Tuesday with the Opening and Awards Ceremonies. We will begin each day of the conference with a single-track Plenary session, followed by parallel track technical sessions. Each day's Plenary session will have a theme based on the CS MANTECH pillars of RF, Power, and Optoelectronics. This year, for the first time, we will kick-off our conference with an Optoelectronics Plenary Session, featuring Plenary speakers Jason Hartlove from Meta and Fred Kish from NC State. The latest in consumer augmented reality displays and photonic integrated circuits (PICs) from these two speakers are sure to impress. Several Invited speakers will be featured in the remaining parallel sessions through the rest of the first day, as we pivot to RF, Power, and Advanced Wafer Processing & Integration. Invited speakers on the first day of our conference will represent Texas Instruments, Hong Kong University, Sumitomo Electric, Mitsubishi Electric, Ritsumeikan University, Purdue University, The Ohio State University, Kanazawa University, IMEC & Aeluma. Following the

day's sessions we will host a Student Forum before the evening International Reception.

On Wednesday, day two of the conference, we start with the Power Plenary session, featuring Umesh Mishra from UC Santa Barbara and Transphorm, who will take on the lively discussion of GaN Power as a non-SiC solution. The two Invited speakers from Infineon Technologies & Wolfspeed will wrap up the single-track session with a SiC perspective. After the Power Plenary session, we will return to parallel sessions on Optoelectronics, RF, Heterogenous Integration, VCESLs, and a little more discussion on Power. Invited speakers from those parallel sessions will represent QROMIS, Cambridge GaN Devices, Yole, Unikorn, NHanced Semi, PseudolithIC, Hiroshima University, Mojo Vision, Thales Alenia Space, and Meijo University.

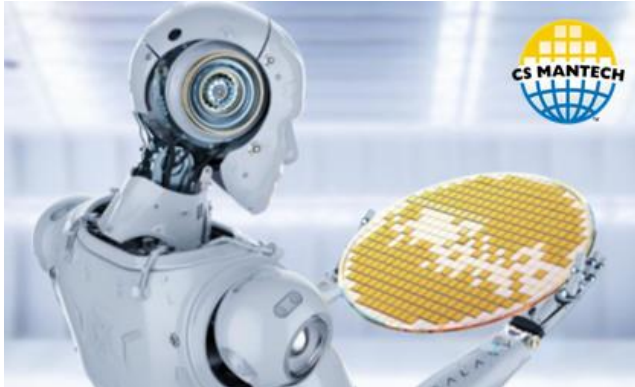
On Thursday, the final day of the conference, we will start with a CHIPS & RF Plenary session, featuring Plenary speakers Eric Lin from the US Department of Commerce CHIPS Research & Development Office and Roger Nichols from Keysight Technologies. We will learn about the latest updates on the CHIPS For America Program and the role of Compound Semiconductors in the transition to 6G wireless technology. After the single-track Plenary, we will switch to parallel-track sessions, with more invited speakers representing Georgia Tech, Element Six, SEMI and Tignis. The sessions will cover Epitaxy & Material, Industry & AI, Metallization & Lithography, and Characterization.

While I've highlighted our excellent Plenary and Invited speakers for this year's program above, we are also excited to have Regular and Student contributions represented in many sessions. The contributions are from academia, government, and industry, and make up the roots of our CS MANTECH conference. Like the past CS MANTECH conferences, these papers bring cutting-edge concepts that are often our first look at things that will change our industry for years to come. That is true for our Poster Session, which will end the technical sessions, and is a great opportunity to interact with the authors and build relationships.

We'll wrap up the conference with a Capstone Talk from Richard Gottscho from Lam Research before our closing ceremonies, where you are sure to be inspired by his "human first, computer last" approach to big data analysis. We hope this Capstone Talk leaves you motivated to go back to your organization with fresh ideas and fresh contacts to do great work in our industry, and we are happy to have you join us during this exciting week!

Shawn Burnham
DCS Corp
Technical Program Committee Chair

CS MANTECH WORKSHOP



The theme for this year's CS MANTECH Workshop is the **"The AI Revolution: Opportunities for Compound Semiconductor Manufacturing."** With recent advances in Artificial Intelligence (AI) and Machine Learning (ML) promising to transform many fields and industries, we are excited to offer a series of talks that highlight their potential for CS manufacturing. Talks will range from a high-level overview of AI opportunities in manufacturing, to the fundamentals of what AI/ML is, to practical use cases that may be implemented in a compound semiconductor foundry in the near-to-medium term.

The Workshop will begin with a talk by Dr. Thomas Gutt of Infineon Technologies AG. Dr. Gutt is the lead of the AIMS 5.0 European Collaboration for Artificial Intelligence in Manufacturing and will present an overview of the exciting projects this organization is supporting across Europe to integrate AI/ML into semiconductor and other manufacturing facilities.

This will be followed by a presentation from Mohammed Shafae of the University of Arizona on artificial intelligence and machine learning fundamentals. This talk will focus on basic theory and defining the terms and methods of AI/ML.

Following this, Tignis Inc. will present two talks on the use of AI/ML for data analysis, correlation, and prediction in a semiconductor foundry. The first will focus on what data infrastructure is needed, with the second focusing on example use-cases and their benefits.

Abhi Rampal from Solid State AI will then present a talk entitled "Evolution of Fab Analytics: From Paper to AI and Beyond," which will include the application of AI to epitaxy techniques. This will be followed by a presentation from Cadence Design Systems on automation and ML opportunities for design and layout of compound circuits.

We will end the Workshop with another talk from University of Arizona, where Pratik Satam will present on the development of a Digital Twin and Virtual Reality (VR) Training Hub for Semiconductor Manufacturing.

This year's CS MANTECH Workshop, "The AI Revolution: Opportunities for Compound Semiconductor Manufacturing," is an excellent opportunity for new and experienced engineers to understand the emerging world of AI/ML and how it might be applied in their organization. Our objective is to give you the tools to understand where, and where not, this exciting new technology can be used for compound semiconductors; and for areas where it can, what are the tools and infrastructure necessary to support it. Be a part of a great learning and sharing opportunity in a workshop environment!!

2024 ROCS WORKSHOP

Monday, May 20, 2024

JW Marriott Starr Pass Resort, Tucson, Az

Room: Tucson Ballroom F

8:00 a.m. – 5:00 p.m.

The 38th annual Reliability of Compound Semiconductors (ROCS) Workshop will be held on the first day of the CS MANTECH conference. The objective is to bring together researchers, manufacturers, and users of compound devices with an emphasis on device reliability, test, failure mechanisms, thermal analysis, radiation effects, and environmental effects, to name just a few areas of interest. This year's agenda features an impressive lineup of Subject Matter Experts from industry and academia sharing their expertise. Papers and tutorials showing the latest results and new developments in all phases of Compound Semiconductor Reliability will be presented and discussed. A full day of Compound Semiconductor Reliability Presentations is being offered, along with a luncheon and two breaks.

INDUSTRY EXHIBITS

The CS MANTECH Exhibition is the premiere annual venue for key CS equipment and material manufacturers and suppliers to showcase their products and technical services. This year we are excited to showcase over 70 companies. Building upon the conference technical focus on CS manufacturing and technology, the Exhibition is an excellent opportunity for participating companies and organization to meet and interact with both existing and future clients and collaborators involved in today's state-of-the-art manufacturing and tomorrow's innovations. This unique opportunity brings researchers, engineers, managers, and the key decision makers who shape and guide the industry all together for face-to-face interactions. Attendees will gain excellent visibility to a wide range of CS-focused participants from around the world who are critical to ensuring your success in the CS community. You are sure to see major suppliers and collaborators and leverage this unique opportunity to efficiently meet with many of your current contacts as well as engage with new contacts all in one place.

The 2024 CS MANTECH Exhibit Hall will be in the JW Marriott Starr Pass Arizona Ballroom, a short walk from the technical sessions which will be held in the Tucson Ballrooms. Exhibits will kick off with the much-anticipated Exhibits Reception at 6:00 pm on Monday, May 20th. The Exhibits Reception will include food and drinks and is an excellent opportunity to catch up with friends, colleagues, suppliers, and fellow competitors. This is the first evening of the conference, providing a casual social environment to network and meet the attendees who contribute to the advancements and continued success of the CS industry.

The Exhibit Hall will open again Tuesday morning, May 21st, with breakfast at 7:00 am. Following the Plenary Session, the Exhibit Hall will be a focal point for attendees as the location for the morning and afternoon breaks, along with our buffet-style Exhibits Lunch. Attendees will have an opportunity to walk the Exhibits floor and talk to exhibitors throughout the day. The Exhibit Hall will open for a final time on Wednesday morning, May 22nd, at 7:00 am with breakfast, and run until 12:00 pm when the Exhibition closes. This last morning of the Exhibits provides an ideal opportunity for both conference attendees and participating Exhibitors to follow up on interest generated during the Exhibits show, exchange business cards, and finalize those last-minute agreements!

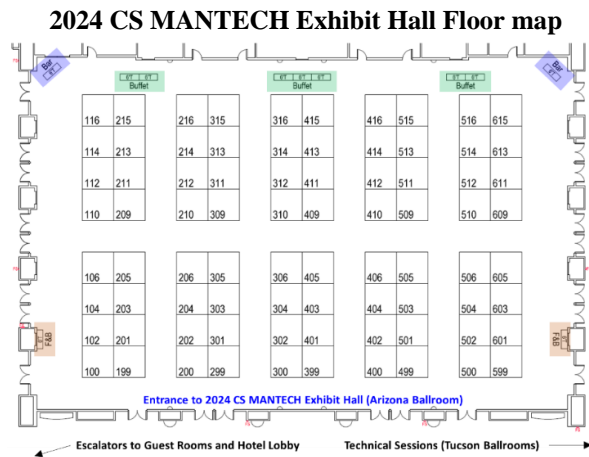
We will also host two Exhibitor Forums to provide an opportunity for participating companies to introduce new products, highlight company strengths, and introduce themselves in a short presentation.

- Forum A: Three parallel sessions, May 21st, 12:20 pm – 1:10 pm, Tucson Ballroom B, C, D

- Forum B: Three parallel sessions, May 21st, 5:20 pm – 6:10 pm, Tucson Ballroom B, C, D

We are very appreciative and thankful for all our CS MANTECH Exhibitors, who not only make our conference possible, but also make it exceptional! We know you will not only find this a very valuable return-on-investment, but a lot of fun, too!

Jansen Uyeda
 2024 CS MANTECH Exhibits Chair
exhibitor@csmantech.org



2024 EXHIBITORS

Company Name	Booth #
4 Dimensions	613
Accel-RF	299
Aixtron Inc.	509
Amtech Systems	210
Annealsys	400
AXT, Inc.	410
Beneq	211/213
Brewer Science, Inc.	316
Brooks Instrument	112
Bruker	209
Burkert Fluid Control Systems	309
C&D Semiconductor	200
Camtek USA, Inc.	500
Canon, USA	601
Center for Semiconductor Manufacturing at The University of Arizona	206
Centrotherm	501
Coherent	510/609
CS CLEAN SOLUTIONS Inc	512
CSconnected	202
CTW Solutions	611
CVD Equipment Corporation	311

Denton Vacuum	205
Disco Hi-Tec America, Inc	503
DOWA Electronics Materials Co., Ltd	404
ECM USA, Inc.	499
Edwards Vacuum	401
Engis Corporation	599
ePAK	514/516
EV Group, Inc.	406
Evatec NA Inc	102
Ferrotec (USA) Corp.	201
Forge Nano	104
Freiberger Compound Materials	312
HORIBA	100
Insaco, Inc.	315
Intelligent Epitaxy Technology (IntelliEPI)	415
JEOL USA, INC	301
JST Manufacturing	304
Kayaku Advanced Materials	314
KLA Corporation	502/504
k-Space Associates, Inc.	216
Laser Thermal	505
LayTec AG	515
Matsuda Sangyo Co., Ltd.	313
Mitsubishi Diamond Industrial Co., Ltd.	412
Neutronix-Quintel	204
Oxford Instruments	214
PlasmaTherm	300/399
Pozzetta	416
Precitec Inc.	605
ProTec Carrier Systems GmbH	513
R2D Automation	511
Raith America, Inc.	411
Rena Technologies North America	615
Roxtec	302
RSC	413
Samco, Inc.	215
S-Cubed	603
SEMILAB	403/405
SIGMAPHI	203
SOMOS IWT, Inc.	306
SPS-America, Inc	506
STR US, Inc.	305
StratEdge Corporation	199
Sumitomo Chemical AT	303
SUSS MicroTec Inc.	110
Trymax USA, Inc	409
Vacuum Engineering & Materials Co., Inc.	114
Valutek, Inc.	106
Veeco	310
Virginia Diodes, Inc.	116
Wolfspeed	414

2023 BEST PAPERS AWARDS

On Tuesday morning, CS MANTECH will formally recognize the authors of the best paper and best student paper from the 2023 conference. Both awards are based on conference attendee online feedback and ratings. The Best Paper Award is named in honor of Dr. He Bong Kim, the founder of the International Conference on Compound Semiconductor Manufacturing Technology.

The He Bong Kim Award winner for 2023 Conference is:

Optical And Electrical Methods for Yield Improvement of T-Shaped Gates for AlGaIn/GaN HEMT

P. Denis, H. Sahin, M. Madel, T. Böhm, L. Trinh-Xuan, T. Berndorfer, A. Hugger, M. Amann, H. Stieglauer, and H. Blanck

United Monolithic Semiconductors GmbH, Ulm, Germany

The Best Student Paper for the 2023 Conference, for which the principal student author will receive a special cash award of \$1000, is:

Fabrication and Analysis of β -Ga₂O₃ Schottky Diodes with Drift Layer Grown by MOCVD on (001) Substrate

Prakash P. Sundaram,¹ Fengdeng Liu,^{1,2} Fikadu Alema,³ Andrei Osinsky,³ Bharat Jalan,² and Steven J. Koester¹

¹*Dept. of Electrical and Computer Engineering, University of Minnesota, Minneapolis, MN, USA*

²*Dept. of Chemical Engineering and Materials Science, University of Minnesota, Minneapolis, MN, USA*

³*Agnitron Technology Incorporated, Chanhassen, MN, USA*

Congratulations to these award-winning teams for their excellent presentation and technical contribution to our field.

INTERNATIONAL RECEPTION



We are thrilled to announce the highlight event of this year's CS MANTECH conference: the International Reception, taking place on Tuesday night at Culinary Dropout. Against the backdrop of eclectic decor and lively ambiance, attendees will have the opportunity to connect with peers, industry leaders, and international delegates in a casual and engaging setting. Indulge in a selection of globally inspired dishes, handcrafted cocktails, and local brews, while fostering meaningful conversations and networking opportunities. With music and fun games enhancing the atmosphere, the International Reception promises to be an unforgettable evening of camaraderie and culinary delights.

One IR ticket is included in your registration. Additional tickets will be available for purchase (please see registration site for details). Buses will load and depart the hotel between 6:15-6:30 PM and then will start to bring attendees back towards the end of the event, scheduled to run until 10:00 PM.

CONFERENCE CLOSING RECEPTION

The Conference Closing Reception brings the 2024 CS MANTECH to an end. Immediately following the technical program, the closing reception affords attendees one last opportunity to exchange business cards, ideas, and experiences as they reflect on the week. During the reception voting for Best Poster Presentation and Picture Contest will be tallied and winners announced.

We are honored to have Richard Gottscho, Executive Vice President and Strategic Advisor to the CEO of Lam Research provide a Capstone Talk for our Conference Closing on Thursday afternoon. The title of his talk is “Accelerating Process Development for Semiconductor Device Fabrication”, and the following is a short preview:

Although chips have been designed by computers for decades, the processes used to manufacture those chips have eluded design based on physics or data. Virtually all processes used to manufacture chips have been developed, not designed, by trial and error – a costly endeavor using highly trained and experienced process engineers searching for a combination of tool parameters that produce an acceptable result on the device.

Out of more than a 100 trillion possibilities! Because the solution space dimensionality is so large and because process development is time-consuming and costly, machine learning approaches have been hampered by too little data. Physics-based approaches suffer from large numbers of unknown parameters and complex equations that require excessive computational time to solve.

This talk will review results and take a behind-the-scenes look at a study, which showed a “human first, computer last” approach could reach process engineering targets dramatically faster and at substantially lower cost compared to today’s empirical approach. The results provide a path to leverage the strengths of human experts and their domain knowledge as well as the strengths of machine learning to deal with “little data” and accelerate the pace of innovation in semiconductor process engineering [Kanarik, et al. Nature 616, 707–711 (2023)].

With all the attention on Artificial Intelligence and Machine Learning, this Capstone Talk is sure to satisfy your curiosity of how these emerging tools can be applied in our industry. You don’t want to miss this important and inspiring Capstone Talk at our Conference Closing ceremonies.



CS MANTECH Capstone Speaker Richard Gottscho, Executive Vice President and Strategic Advisor to the CEO of Lam Research

The Conference Closing Reception and Ceremonies provide attendees one last chance to make connections and exchange contact information with new colleagues within our community. It is also a fitting opportunity to reflect on what has been discussed throughout the week, and how we can all benefit our organizations and the industry.

We also ask that each attendee complete a CS MANTECH Feedback Survey to provide your input on what you enjoyed and what might be improved for next year, so that we can continue to improve our conference. These surveys are also critical to help determine the Best Paper & Best Student Paper awards, and we plan to have a prize raffle drawing of all who have completed the survey. During the closing ceremonies, we will also announce the winners for the Best Poster and the CS MANTECH AI Picture Challenge

contest. Plan to be there for the fun, excitement and important Capstone Talk!

CONFERENCE CONTEST

Last year's conference contest was the Best AI-Generated Image. This year, with a slight twist, we will continue to ride the wave of AI popularity but test your ability to determine if an image is AI generated, or not! Participants can submit images by email to tpcchair@csmantech.org any time before 12 PM Thursday for a chance to win. Attendees will use the CS MANTECH App to view submitted images and vote if the image was AI generated or not. The image submission with the most **wrong** votes wins! Do your best to try to trick your colleagues with interesting image submissions!



Conference contest: AI generated, or not??

As in previous years, our conference will hold a Feedback Form Raffle. Conference feedback on technical content and venue is valuable to the CS MANTECH committees in structuring the conference and technical program from year to year. In addition, conference feedback is used to help select the Best Paper and Best Student Paper. Each Feedback Form submitted will be entered into a raffle for a prize. It's as simple as that! The drawing will be held during the closing reception, though the winner need not be present to win.

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Celicia Della-Morrow	<i>Qorvo</i>
Chang'e Weng	<i>Lam Research</i>
Chang-Hwang Hua	<i>Win Semiconductors Corp.</i>
Chris Santana	<i>IQE</i>
Chuanxin Lian	<i>Qorvo</i>
Chun-Lim Lau	<i>Retired</i>
Corey Nevers	<i>Qorvo</i>
David Meyer	<i>Naval Research Laboratory</i>
David Via	<i>AFRL</i>
David Wang	<i>GCS</i>
Dilip Risbud	<i>Renesas Electronics</i>
Doug Campbell	<i>E-Pak</i>
Drew Hanser	<i>Veeco</i>
Dwaraka Geerapuram	<i>Plasma-Therm</i>
Elizabeth Keenan	<i>Qorvo</i>
Eric Stewart	<i>Northrop Grumman</i>
Ezgi Dogmus	<i>Yole</i>
Fabian Radulescu	<i>MACOM</i>
Franklin Monzon	<i>HRL Laboratories</i>
Fumimasa Horikiri	<i>Sumitomo Chemical Co. Ltd.</i>
Gerhard Schoenthal	<i>VDI</i>
Greg Mills	<i>ANNEALSYS AXR</i>
Guoliang Zhou	<i>Skyworks</i>
Haldane Henry	<i>Qorvo</i>

Heribert Zull	<i>ams OSRAM Group</i>
Hermann Stieglauer	<i>UMS</i>
Hidetoshi Kawasaki	<i>Tower Partners Semiconductor</i>
Hong Lin	<i>Soitec</i>
Jansen Uyeda	<i>Northrop Grumman</i>
Jeffrey LaRoche	<i>Raytheon</i>
Jim Crites	<i>Blue Ridge Semiconductors</i>
John Carlson	<i>HRL Laboratories</i>
Justin Parke	<i>Northrop Grumman</i>
Keisuke Shinohara	<i>Teledyne</i>
Keith Wieber	<i>Qorvo</i>
Kevin Stevens	<i>IQE</i>
Kezia Cheng	<i>Skyworks</i>
Kyle Bothe	<i>MACOM</i>
Lena Luu	<i>GCS</i>
Mario Faria	<i>Tignis</i>
Martin Huber	<i>NexGen Wafer Systems</i>
Martin Kuball	<i>University of Bristol</i>
Marty Brophy	<i>Consultant</i>
Matthew Tyhach	<i>Raytheon</i>
Michelle Bourke	<i>Lam Research</i>
Mike Krames	<i>Arkesso, LLC</i>
Mitsuhiro Nakamura	<i>Murata manufacturing company</i>
Naveen Tipirneni	<i>Teknismart Solutions Inc</i>
Nicholas Dellas	<i>Infineon Technologies</i>
Pat Holly	<i>Northrop Grumman</i>
Patrick Fay	<i>Univ. of Notre Dame</i>
Paul Pinsukanjana	<i>IntelliEPI</i>
Peter Ersland	<i>MACOM</i>
Rathnait Long	<i>MACOM Technology Solutions</i>
Robert Sadler	<i>MACOM</i>
Sarang Kulkarni	<i>Raxium, Google</i>
Scott Sheppard	<i>MACOM</i>
Shawn Burnham	<i>JPO/DCS Corp</i>
Shiva Rai	<i>Applied Materials</i>
Shyh-Chiang Shen	<i>Vanguard International Semiconductor</i>
Staci Moulton	<i>ForgeNano</i>
Stephanie Chang	<i>Skyworks</i>
Steve Mahon	<i>Feldman Engineering</i>
Susan Stevens	<i>Analog Devices</i>
Takuji Yamamura	<i>Sumitomo Electric Industries, Ltd.</i>
Temel Buyuklimanli	<i>Eurofins EAG Laboratories</i>
Thomas Roedle	<i>Infineon Technologies AG</i>
Thorsten Saeger	<i>Qorvo Inc.</i>
Travis Abshere	<i>nLight</i>
Walter Wohlmuth	<i>Sino American Silicon Products</i>
Wei Zhang	<i>AXT, Inc.</i>
Wen Zhu	<i>BAE Systems</i>
Winston Parker	<i>Wolfspeed</i>
Yoganand Saripalli	<i>Texas Instruments</i>
Yogi Ota	<i>Duet RF Solutions</i>
Yohei Otoki	<i>Sumitomo Chemical</i>

TECHNICAL PROGRAM

Monday, May 20th

6:00 PM **EXHIBITOR RECEPTION**

Tuesday, May 21st

CONFERENCE OPENING

- 8:00 AM **Opening Ceremonies**
David Meyer, Naval Research Laboratory
Conference Chair
- 8:05 AM **2023 Conference Best Paper Awards**
David Meyer, Naval Research Laboratory
Conference Chair
- 8:10 AM **Technical Program Highlights**
Shawn Burnham, *DCS Corp*
Technical Program Chair

SESSION 1.0: OPTOELECTRONICS PLENARY

Chairs: Mike Krames, *Arkesso*
Shawn Burnham, *DCS Corp*

- 8:15 AM *Plenary Presentation*
1.0.1 Bridging Realities: Compound Semiconductor Solutions for Next-Generation Augmented Reality Displays
Jason Hartlove
Meta
- 9:00 AM *Plenary Presentation*
1.0.2 Photonic Integrated Circuits (PICS): From InP to GaN-based Solutions
Fred A. Kish
North Carolina State University

09:45 AM **BREAK**

SESSION 2.1: POWER I

Chairs: Naveen Tipirneni, *Teknismart Solutions Inc*
Ezgi Dogmus, *Yole Group*

- 10:30 AM *Invited Presentation*
2.1.1 Key Challenges in Process Development for Future High Voltage GaN Roadmap
Jungwoo Joh, Qhalid Fareed, Yoga Saripalli,

Dong Seup Lee, Ethan Lee, Pinghai Hao,
Seetharaman Sridhar, Sameer Pendharkar
ATD, Texas Instruments

11:00 AM *Invited Presentation*

2.1.2 Expanding the Scope of GaN Power Integration

Kevin J. Chen, Sirui Feng, Tao Chen,
Zheyang Zheng, Jin Wei, Gang Lyu, Li
Zhang
*The Hong Kong University of Science and
Technology*

11:30 AM **2.1.3 Experimentally Validated Innovative Edge Termination for Vertical GaN Diodes**

Alan G. Jacobs¹, James Spencer Lundh², Pra-
kash Pandey³, Tolen Nelson³, Daniel G.
Georgiev³, Andrew D. Koehler¹, Raghav
Khanna³, Marko J. Tadjer¹, Karl D. Hobart¹,
Travis J. Anderson¹

¹*U.S. Naval Research Laboratory, Washing-
ton, DC, USA*

²*National Research Council Postdoctoral
Fellow, Residing at U.S. Naval Research La-
boratory, Washington, DC, USA*

³*Department of Electrical Engineering and
Computer Science, University of Toledo, OH,
USA*

11:50 AM **2.1.4 Overlapping Source Field Plate Process Module For High-Voltage GaN HFETs With Low Off State Leakage Currents**

Houssam Halhoul, Ralph-Stephan Unger,
Frank Brunner, Oliver Hilt
*Ferdinand-Braun-Institut (FBH), Leibniz-In-
stitut für Höchstfrequenztechnik, Berlin, Ger-
many*

SESSION 2.2: RF DEVICES I

Chairs: Peter Ersland, *MACOM*
Justin Parke, *Northrop Grumman*

10:30 AM *Invited Presentation*

**2.2.1 High Power Nitrogen-polar GaN/In-
AlN HEMT with Record Power Density of
12.8 W/mm at 28 GHz**

S. Yoshida, K. Makiyama, A. Hayasaka, A.
Mukai, I. Makabe, and K. Nakata
*Transmission Devices Laboratory, Sumitomo
Electric Industries, Ltd., Yokohama, Kana-
gawa, Japan*

11:00 AM *Invited Presentation*

2.2.2 X-band GaN HEMT and Free-standing GaN Substrate for Marine Radar

E. Yagyū¹, D. Tsunami^{1,2}, T. Matsuura¹, T. Furuhashi¹, M. Nakamura¹, T. Matsuda¹, K. Kuwata³, T. Kobayashi⁴

¹*Advanced Technology R&D Center, Mitsubishi Electric Corporation, Hyogo, Japan*

²*High-frequency and Optical Device Works, Mitsubishi Electric Corporation, Hyogo*

³*Information Technology R&D Center, Mitsubishi Electric Corporation, Kanagawa*

⁴*Research and Innovation Center, Furuno Electric Co. Ltd., Hyogo*

11:30 AM **2.2.3 Depleted AlN/Si Interfaces For Minimizing RF Loss In GaN-on-Si HEMTs**

H. Hahn¹, C. Mauder¹, M. Marx¹, Z. Gao¹, P. Lauffer¹, O. Schön¹, P. T. John¹, S. Yadav², S. Banerjee², P. Cardinael³, J.-P. Raskin³, B. Parvais^{2,4}, D. Fahle¹

¹*AIXTRON SE, Herzogenrath, Germany,*

²*imec, Leuven, Belgium,*

³*Université catholique de Louvain (UCLouvain), Place du Levant; Louvain-la-Neuve, Belgium,*

⁴*Vrije Universiteit Brussels, Dep. ETRO, Brussels, Belgium*

11:50 AM **2.2.4 The 50V GaN HEMT with Memory Effect Suppression**

Wayne Lin, Wen-Hsin Wu, Chien-Rong Yu, Yu-Li Ho, Edison Chou, Jia-Jyun-Guo, Che-Kai Lin, Wei-Chou Wang, Yu-Syuan Lin, Cheng-Kao Lin
WIN Semiconductors Corp., Tao-Yuan City, R.O.C.

12:10 PM **EXHIBITS LUNCH**

12:20 PM **EXHIBITOR FORUM**
Tucson Ballroom B, C, D

SESSION 3.1: ADVANCED WAFER PROCESSING

Chairs: Hermann Stieglauer, *UMS*
Lena Luu, *GCS*

1:15 PM *Invited Presentation*
3.1.1 Electrochemical Mechanical Polishing of SiC Wafer Using Solid Polymer Electrolyte
J. Murata
Department of Mechanical Engineering, 1-1-1 Noji-higashi, Kusatsu, Shiga, Japan

- 1:45 PM **3.1.2 Electrochemical Additive Selection for Non-Cyanide Gold Plating Bath for Uniform Thickness Gold Layer for GaAs Backside Metallization**
Shoei Mizuhashi, Yusuke Sato, Yuichiro Shindo
Precious Metals Materials Division, Matsuda Sangyo Co., Ltd, Tokyo, Japan
- 2:05 PM **3.1.3 Optimization of AlScN Etch Processes Ensuring Minimum Bottom Electrode Loss**
Samira Kazemi, Janet Hopkins
KLA Corporation (SPTS Division), Newport NP18 2TA, UK
- 2:25 PM **3.1.4 Plasma Dicing for High Yield SiC Singulation**
A. Croot¹, B. Jones², J. Mitchell¹, H. Ashraf¹, J. Hopkins¹, M. Jennings², O.J Guy²
¹*KLA Corporation (SPTS Division), Ringland Way, NP18 2TA, Newport, UK,*
²*Swansea University, Singleton Park, SA2 8PP, Swansea, UK*

SESSION 3.2: RF DEVICES II

Chairs: Gerhard Schoenthal, *VDI*
Keisuke Shinohara, *Teledyne*

- 1:15 PM *Invited Presentation*
3.2.1 Ultra-thin Indium Oxide Thin-film Transistors with Gigahertz Operation Frequency
Adam Charnas, Dongqi Zheng, Peide D. Ye
Elmore Family School of Electrical and Computer Engineering and the Birck Nanotechnology Center, Purdue University, West Lafayette, IN, USA
- 1:45 PM *Student Presentation*
3.2.2 Improved Thermal Reliability In Base Contact of Full 3-inch InP Double-HBTs With f_T and f_{max} In Excess of 300 GHz
In-Geun Lee¹, Yong-Soo Jeon¹, Yonghyun Kim², Jacob Yun², Ted Kim², Hyuk-Min Kwon³, Seung Heon Shin³, Jae-Hak Lee¹, Kyunghoon Yang⁴ and Dae-Hyun Kim¹
¹*School of Electronic and Electrical Engineering, Kyungpook National University, Daegu, South Korea*
²*QSI, Cheon-An, Chungcheongnam-do, South Korea*

³ Semiconductor Convergence Campus, Korea Polytechnics, Anseong-si, South Korea
⁴ School of Electrical Engineering, Korea Advanced Institute of Science and Technology, Daejeon, South Korea

2:05 PM *Student Presentation*
3.2.3 5-level stacked In_{0.53}Ga_{0.47}As Multi-Bridged Channel Field-Effect Transistors
J.H. Yoo¹, H.B. Jo^{1,2}, I.G. Lee¹, S.M. Choi¹, H.J. Kim¹, W.S. Park¹, H. Jang³, C.S. Shin³, K.S. Seo³, S.H. Shin⁴, H.M. Kwon⁴, S.K. Kim⁵, J.G. Kim⁵, J. Yun⁵, T. Kim⁵, J.H. Lee¹, D.H. Kim¹
¹School of Electronic and Electrical Engineering, Kyungpook National University, Daegu, 41566, South Korea,
²KETI, Seongnam, Kyunggi-do, South Korea,
³KANC, Suwon, Kyunggi-do, South Korea
⁴Polytech, Incheon, 21417, South Korea and
⁵QSI, Cheon-An, Kyunggi-do, South Korea

2:25 PM **3.2.4 70 nm GaAs pHEMT for D-band Power Amplifier Application**
Lung-Yi Tseng, Li-Cheng Chang, Jung-Tao Chung, Hsi-Tsung Lin, Shu-Hsiao Tsai, Cheng-Kuo Lin
WIN Semiconductors Corp., Taoyuan City 333, Taiwan

2:45 PM **BREAK**

SESSION 4.1: POWER II

Chairs: Yoganand Saripalli, *Texas Instruments*
Martin Huber, *NexGen Wafer Systems*

3:20 PM *Invited Presentation*
4.1.1 Electrostatic Engineering for High-Performance Gallium Oxide Devices
Sushovan Dhara¹, Ashok Dheenani¹, Nathan Wriedt¹, Joe McGlone¹, Jinwoo Hwang², Steven Ringel^{1,2}, Hongping Zhao^{1,2}, and Sidharth Rajan^{1,2}
¹Department of Electrical and Computer Engineering, The Ohio State University, Columbus, OH, USA
²Department of Materials Science and Engineering, The Ohio State University, Columbus, OH, USA

3:50 PM *Invited Presentation*
4.1.2 Progress in Diamond MOSFET Technologies
N. Tokuda¹, T. Matsumoto¹, X. Zhang¹, K. Sato¹, K. Kobayashi¹, K. Ichikawa¹, K.

Hayashi¹, T. Inokuma¹, S. Yamaski¹, C.E. Nebel^{1,2}, M. Ogura³, H. Kato³, T. Makino³, D. Takeuchi³

¹Kanazawa University Kakuma-machi, Kanazawa 920-1192, Japan

²Diamond and Carbon Applications, Freiburg 79102, Germany

³National Institute of Advanced Industrial Science and Technology, Tsukuba, Japan

4:20 PM **4.1.3 Influence of Carbon Capping Materials during High Temperature Annealing on Surface, Defects and Dopant Profile in SiC**

J. A. Turcaud¹, D. Lee², D. Rossman¹, J. Schuur¹ & R. Chebi¹

¹Coherent Corp., San Jose, CA, USA

²Coherent Corp., Warren, NJ, USA

4:40 PM **4.1.4 Wafer Bow Tuning with Stealth Laser Patterning for Vertical High Voltage Devices with Thick GaN Epitaxy on Sapphire Substrates**

Enrico Brusaterra, Eldad Bahat Treidel, Alexander Külberg, Frank Brunner, Mihaela Wolf and Oliver Hilt

Ferdinand-Braun-Institut (FBH), Berlin, Germany

SESSION 4.2: CS AND Si INTEGRATION

Chairs: Barry Wu, *Keysight Technologies, Inc*
David Wang, *GCS*

3:20 PM *Invited Presentation*

4.2.1 Silicon Meets Compound Semiconductors: Pioneering Wireless Communications

J. N. Collaert¹, R. Alcotte, A. Alian, M. Asad, I. Bagal², S. Banerjee, G. Boccardi, P. Cardinael³, I. Comart, C. Desset, R. ElKashlan, F. Filice, G. Gramegna, H. Jafarpoorchekab, A. Khaled, A. Kumar, B. Kunert, Y. Mols, B. O'Sullivan, S. Park, U. Peralagu, N. Pinho, A. Rathi, A. Sibaja-Hernandez, S. Sinha, D. Smellie², X. Sun, A. Vais, B. Vanhouche¹, B. Vermeersch, D. Xiao, S. Yadav, D. Yan¹, H. Yu, Y. Zhang, J. Van Driessche, P. Wambacq¹, M. Peeters, B. Parvais¹

¹Imec, Heverlee, Belgium;

²VUB, Belgium

³KU Leuven, Belgium;

⁴UC Louvain, Belgium

3:50 PM *Invited Presentation*

**4.2.2 Heterogeneously Integrated
Compound Semiconductors on Large-
Diameter Substrates for Scaling to
Consumer Market Volumes**

Jonathan Klamkin

Aeluma

4:20 PM **4.2.3 A Monolithic III-V on Si Integration
Technology Utilizing 300mm CMOS
Platform**

G. Boccardi¹, A. Vais¹, A. Kumar¹, S.
Yadav¹, Y. Mols¹, R. Alcotte¹, L. Witters¹, J.
De Backer¹, A. Mingardi¹, A. Milenin¹, K.
Vandersmissen¹, N. Heylen¹, K. Ceulemans¹,
D. Goossens¹, F. Sebaai¹, J-P. Soulié¹, R.
Langer¹, B. Kunert¹, B. Parvais^{1,2}, and N.
Collaert^{1,2}

¹ *imec, Leuven, Belgium*

² *VUB, Brussels, Belgium*

4:40 PM **4.2.4 200-mm Enhancement-Mode Low-
Knee-Voltage GaN-on-Si MISFETs for
High Frequency Handset Applications**

Vincent Johnson, Zev Pogrebin, Mark
Dipse, Hal S. Emmer, Yuxuan Zhang,
Dongfei Pei, and Bin Lu

Finwave Semiconductor Inc., Waltham, MA

5:15 PM **EXHIBITOR FORUM**
Tucson Ballroom B, C, D

5:15 PM **STUDENT FORUM**
Tucson Ballroom J

6:15 PM **BUSSES DEPART FOR IR**
Designated departure location

7:00 PM **INTERNATIONAL RECEPTION**
Culinary Dropout, Tucson

Wednesday, May 22nd

SESSION 5.0: POWER PLENARY

Chairs: Dilip Risbud, *Renesas Electronics*
Martin Kuball, *University of Bristol*

- 8:00 AM *Plenary Presentation*
5.0.1 GaN Power: The Solution That Is Not SiC
Umesh Mishra
University of California, Santa Barbara, CA
- 8:45 AM *Invited Presentation*
5.0.2 SiC Power Devices As Key Enabling Components for The Green Energy Transition – How The Growth Journey Began And Will Go On
Peter Friedrichs
Infineon Technologies AG
- 9:15 AM *Invited Presentation*
5.0.3 Large Scale Commercialization of Silicon Carbide for EV
Frank Ferrante
Wolfspeed
- 9:45 AM **BREAK**

SESSION 6.1: POWER III

Chairs: Andy Souzis, *Coherent*
Nicholas Dellas, *Infineon Technologies*

- 10:30 AM *Invited Presentation*
6.1.1 Taking GaN to the Next Level of 100 V to 2000 V and Beyond Scalability with the Revolutionary 200 mm and 300 mm QST® Manufacturing Platform
C. Basceri¹, V. Odnoblyudov¹, C. Kurth¹, M. Yamada², S. Konishi², M. Kawahara², C.C. Liao³, S. Shen³, J. Chiu³, K. Geens⁴, A. Vohra⁴, H. De Pauw^{4,5}, B. Bakeroot^{4,5}, S. Decoutere⁴, H. Hahn⁶, M. Heuken⁶ and K. Tanigawa⁷
¹*QROMIS, Inc., Santa Clara, CA, USA*
²*SHIN-ETSU CHEMICAL Co., Ltd., Tokyo, Japan*
³*VANGUARD INTERNATIONAL SEMICONDUCTOR Corp., Taiwan*
⁴*IMEC, Leuven, Belgium*
⁵*CMST, imec & Ghent University, Ghent, Belgium*
⁶*AIXTRON SE, Herzogenrath, Germany*
⁷*OKI ELECTRIC INDUSTRY Co., Ltd., Tokyo, Japan*

- 11:00 AM *Invited Presentation*
6.1.2 GaN Power ICs Bring Highest Levels of Sustainability Through Manufacturing Processes and End-Equipment Applications
 Peter Di Maso
Cambridge GaN Devices, Cambridge, CB4 0DS, U.K
- 11:30 AM **6.1.3 SmartSiC™ 150 & 200mm Engineered Substrate: Increasing SiC Power Device Current Density Up To 30%**
 Daniel Eric Guiot¹, Frédéric Allibert¹, Jürgen Leib², Tom Becker², Oleg Rusch², Alexis Drouin¹, Walter Schwarzenbach¹
¹SOITEC S.A., Bernin, France
²Fraunhofer IISB, Erlangen, Germany
- 11:50 AM *Student Presentation*
6.1.4 Thermally Stable Normally-off 1200V Cascoded AlGaIn/GaN HEMT Using Buffer-Free Structure on 6" SiC Substrate
 Chong-Rong Huang¹, Hsien-Chin Chiu¹, Chao-Wei Chiu¹, Hsuan-Ling Kao¹, Yong-Xiang Zhuang¹, Yang-Ching Ho¹, Chen-Kang Chuang¹, Chih-Tien Chen² and Kuo-Jen Chang²
¹Department of Electronics Engineering, Chang Gung University, Taiwan
²National Chung-Shan Institute of Science and Technology, Materials and Electro-Optics Research Division, Taiwan

SESSION 6.2: OPTOELECTRONIC MANUFACTURING

Chairs: Travis Abshire, *nLight*
 Shiva Rai, *Applied Materials*

- 10:30 AM *Invited Presentation*
6.2.1 Will microLED Succeed In High Volume Consumer Applications?
 Eric Virey, Raphael Mermet-Lyauoz, Zine Bouhamri, Ali Jaffal
Yole group, Le Quartz, 75 cours Emile Zola, 69100 Lyon Villeurbanne, France
- 11:00 AM *Invited Presentation*
6.2.2 Micro LED Technology and Platform Trend
 Sam Chen, HaoMin_Ku, Chingen_Huang, TzuLing_Yang, Jimmy_Shen
Unikorn Semiconductor, Li-hsin 5th Rd., Hsinchu Science Park, Hsinchu 300, Taiwan

11:30 AM **6.2.3 Plasma-Etch End-Pointing in InP-Based Laser Device Structures**
J. Decobert¹, N. Vaissiere¹, D. Micha¹, D. Néel¹, M. Binetti², A. Adrian², C. Lörchner-Gerdaus², D. Cornwell², N. Rezaei-Hartmann², T. Brand², A. Martinez², K. Haberland², J.-T. Zettler²
¹*III-V Lab, a joint lab of Nokia, Thales and CEA-Leti, 1, Avenue Augustin Fresnel 91767 Palaiseau Cedex, France.*
²*LayTec AG Seesener Str. 10-13, 10709 Berlin, Germany DC*

11:50 AM *Student Presentation*
6.2.4 Develop Automated Oxide-Aperture Size Measurement for GaAs VCSELs
Zetai Liu, Haonan Wu, Derek Chaw, Milton Feng
Department of Electrical and Computer Engineering, University of Illinois at Urbana-Champaign
Nick Holonyak Micro and Nanotechnology Laboratory, 208 N Wright St, Urbana, IL,

12:10 PM **LUNCH BREAK**

SESSION 7.1: HETEROGENEOUS INTEGRATION

Chairs: Alex Smith, *Brewer Science*
Andy Carter, *Northrop Grumman*

1:30 PM *Invited Presentation*
7.1.1 Implementing 2.5D and 3D Heterogeneous Integrate Systems in Package
Robert Patti
NHanced Semiconductors

2:00 PM *Invited Presentation*
7.1.2 The Accelerating Future of Heterogeneous Integration
D.S. Green, J.J. Kim, M.D. Hodge, M.R. Soler, F. Herrault, J.F. Buckwalter
PseudolithIC Inc., Santa Barbara, CA

2:30 PM *Invited Presentation*
7.1.3 Recovery of Constituent Elements and Crystal Growth of Compound Semiconductors using Marine Bacteria
Yoriko Tominaga
Hiroshima University, Japan

SESSION 7.2: OPTOELECTRONIC DEVICES

Chairs: John Carlson, *HRL*
Winston Parker, *Wolfspeed*

- 1:30 PM *Invited Presentation*
7.2.1 Mass transfer of Efficient < 5µm MicroLED Chips For Efficient and High-Performance SmartWatch Displays
Philippe Gilet, Markus Broell, Mickael Mairy, Pierre Tchoulfian, Clément Talagrand, Willy Ludurczak, Thomas Lacave, Ivan-Christophe Robin, Xavier Hugon
ALEDIA SAS, Parc Sud Galaxie, 10 rue des Méridiens, 38130 ECHIROLLES FRANCE
- 2:00 PM *Invited Presentation*
7.2.2 Micro-LED Maturation from beachhead in AR/VR to entire Display Market
Paul Martin
Mojo Vision, USA
- 2:30 PM *Student Presentation*
7.2.3 1.6 µm Lasing and Mid-Wave Infrared Detection in InP-Based Transistor-Injected Quantum Cascade Structures
Robert B. Kaufman¹, Raman Kumar², Fu-Chen Hsiao³, and John M. Dallesasse¹
¹*University of Illinois at Urbana-Champaign, Department of Electrical and Computer Engineering, Urbana, IL, USA*
²*City College of New York, Department of Physics, New York, NY, USA*
³*Department of Electrical and Computer Engineering, North Carolina State University, Raleigh, NC, USA*
- 2:50 PM *Student Presentation*
7.2.4 Edge Termination Engineering with Shallow Bevel Mesas for Low-Leakage Vertical GaN-based p-i-n Avalanche Photodiode
Zhiyu Xu¹, Theeradetch Detchprohm¹, Shyh-Chiang Shen¹, A. Nepomuk Otte², and Russell D. Dupuis¹
¹*School of Electrical and Computer Engineering, Georgia Institute of Technology, Atlanta, GA, USA*
²*School of Physics, Georgia Institute of Technology, Atlanta, GA, USA, WA*

3:10 PM **BREAK**

SESSION 8.1: GaN RF DEVICES AND CIRCUITS

Chairs: Haldane Henry, *Qorvo*
Kyle Bothe, *MACOM*

- 3:30 PM *Invited Presentation*
8.1.1 RF Packaging Challenges for High Efficiency, Space Compliant RF Power Amplifier
Olivier Vendier
Thales Alenia Space
- 4:00 PM *Student Presentation*
8.1.2 Design, Fabrication, and Characterization of GaN-Based Single Drift Region IMPATT Diodes
Zhongtao Zhu¹, Lina Cao², Yu Duan¹, Wesley Turner¹, Jinqiao Xie³, and Patrick Fay¹
¹*University of Notre Dame, Notre Dame, IN, USA*
²*Keysight Technologies, Pasadena, CA, USA*
³*Qorvo, Richardson, TX, USA*
- 4:20 PM **8.1.3 High Temperature Operation of GaN High Electron Mobility Transistors on Large-Area Engineered Substrates for Extreme Environments**
James Spencer Lundh¹, Alan G. Jacobs², Michael E. Liao¹, Joseph A. Spencer^{2,3}, Geoffrey M. Foster², Andrew D. Koehler², Vladimir Odnoblyudov⁴, Marko J. Tadjer², Karl D. Hobart², Travis J. Anderson²
¹*National Research Council Postdoctoral Fellow, Residing at NRL, Washington DC, USA*
²*U.S. Naval Research Laboratory, Washington, DC, USA*
³*Center for Power Electronics Systems, Virginia Polytechnic Institute and State University, Blacksburg, VA, USA*
⁴*Qromis, Inc., Santa Clara, CA, USA*
- 4:50 PM **8.1.4 i-line Lithography Technology for 0.25 μm GaN-HEMTs for Future Base Station**
T. Yoshida, Y. Mekata, S. Nishizawa, and F. Yamaki²
Sumitomo Electric Devices Innovations, Inc., Nakakoma-gun, Yamanashi, JAPAN

SESSION 8.2: VCSELs

Chairs: Wei Zhang, *AXT*
Paul Pinsukanjana, *Intelliepi*

3:30 PM *Invited Presentation*

8.2.1 In-situ Epitaxial Growth Control of GaN-Based Vertical-Cavity Surface-Emitting Lasers

T. Takeuchi, S. Kamiyama, and M. Iwaya
Department of Materials and Science and Engineering, Meijo University, Tempaku-ku, Nagoya, Japan

4:00 PM **8.2.2 QuickSELs Enabling Rapid Feedback to Epitaxy**

J. Baker¹, S. Gillgrass¹, C. P. Allford¹, J. I. Davies², S. Shutts¹, P. M. Smowton^{1,3}
¹*School of Physics and Astronomy, Cardiff University, UK*
²*IQE plc, Cardiff UK*
³*Institute for Compound Semiconductors, Cardiff University, UK*

4:20 PM *Student Presentation*

8.2.3 Polarization Control in Vertical-Cavity Surface-Emitting Lasers via Elliptical Aperture Definition in Optical Coatings

Kevin Pikul¹, Leah Espenhahn, Patrick Su, Mark Kraman, John M. Dallesasse
University of Illinois at Urbana-Champaign, Department of Electrical and Computer Engineering, Urbana, IL, USA

4:40 PM *Student Presentation*

8.2.4 Thermal Stability Enhancement of P-Metals Ohmic Contact in Oxide-VCSELs

Derek Chaw, Haonan Wu, Zetai Liu, and Milton Feng
Department of Electrical and Computer Engineering, University of Illinois at Urbana-Champaign, Holonyak Micro & Nanotechnology Lab, 208 North Wright Street, Urbana, IL, USA

Thursday, May 23rd

SESSION 9.0: CHIPS & RF PLENARY

Chairs: David Via, *AFRL*
Andrew Green, *AFRL*

8:15 AM *Plenary Presentation*
9.0.1 Updates on CHIPS for America
Eric Lin
*CHIPS Research & Development Office at
the U.S. Department of Commerce, USA*

9:00 AM *Plenary Presentation*
**9.0.2 The Essential Role of Compound
Semiconductors in the Transition to 6G
Wireless**
Roger Nichols
Keysight Technologies, USA

9:45 AM **BREAK**

SESSION 10.1: EPITAXY & MATERIALS

Chairs: Drew Hanser, *Veeco*
Andrew Wibowo, *MicroLink Devices*

10:15 AM *Invited Presentation*
**10.1.1 Semiconducting AlN: A New Rap-
idly Emerging III-Nitride Market**
W. Alan Doolittle
Georgia Tech, GA, USA

10:45 AM *Invited Presentation*
**10.1.2 A Review of Key Developments and
Challenges in CVD Diamond Substrates
for Electronic Device Applications**
Daniel Twitchen
Element Six

11:15 AM **10.1.3 3D Diamond Growth for GaN Cool-
ing and TBR Reduction**
Daniel Francis
Akash Systems, USA

11:35 AM **10.1.4 Thermal Dissipation Enhancement
Using a Metal-Diamond Composite Heat
Spreaders in High Power RF MMICs**
Zeina Abdallah¹, James W. Pomeroy^{1,2}, and
Martin Kuball^{1,2}
¹*Center for Device Thermography and Relia-
bility (CDTR), University of Bristol, Bristol
BS8 1TL, UK*
²*TherMap Solutions, 1 Victoria St, Redcliffe,
Bristol BS1 6AA, UK*

SESSION 10.2: INDUSTRY & AI

Chairs: Thorsten Saeger, *Qorvo*
Celicia Della-Morrow, *Qorvo*

- 10:15 AM *Invited Presentation*
10.2.1 CHIPS Act and its Impact on the Compound Semiconductor Industry
Melissa Grupen-Shemansky
CTO and VP of Technology Communities, SEMI, USA
- 10:45 AM *Invited Presentation*
10.2.2 Why Every Fab Should be Using AI
Jonathan L. Herlocker
Tignis, Inc, WA, USA
- 11:15 AM **10.2.3 Leveraging Smart Factory Principles for Chemical Usage and Cost**
Mark J. Miller, Joaquin Currier Cubero, M. Arif Zeeshan
Skyworks Solutions Inc., Woburn, MA, USA
- 11:35 AM **10.2.4 Benefits of Implementing AI/ML Controllers for Semiconductor Manufacturing, Including Multi-Tool Co-Optimization**
M. Eric Holzer, Mario Faria
Tignis, Inc, WA, USA
- 11:55 AM **CS MANTECH LUNCHEON**

SESSION 11.1: METALLIZATION & LITHO

Chairs: Dwaraka Geerpuram, *Plasma-Therm*
Wen Zhu, *BAE*

- 1:00 PM **11.1.1 Developments in GaAs Photolithography Processing for Improved HBT Base Metal Patterning and Reduced Photoresist Popping and Tearing**
A. Molina, B. Grisafe, M. Broda, H. K. Nguyen, J. S. Mason
Northrop Grumman Mission Systems, Advanced Technology Laboratory, Linthicum, MD, USA
- 1:20 PM **11.1.2 Optimization of Photolithography Process for BiHEMT Gate Layer with High Critical Dimension Uniformity**
Stephanie Y. Chang, Tom Brown, Randy Bryie, Rainier Lee
Skyworks Solutions, Inc., Newbury Park, CA, USA

- 1:40 PM **11.1.3 Novel Nichrome Thin Film Resistor Fabrication Approach in E-Beam Evaporation for High Volume Semiconductor Manufacturing**
 Sheikh Pradeep Waduge*, Debdas Pal, Peter Ersland, Sam June, Chris Samson, Vince Hoang, Shanali Weerasinghe
MACOM Technology, Lowell, MA, USA
- 2:00 PM *Student Presentation*
11.1.4 Subtractive WSiN Thin Film Resistors for RF GaN and InP MMICs
 Hossein Yazdani, Hady Yacoub, Amer Basal, Taylor Moule, Joost Wartena, Oliver Hilt
Ferdinand-Braun-Institut für Höchstfrequenztechnik (FBH), Berlin, Germany
- 2:20 PM **11.1.5 Electron-beam Deposition with Low- Spitting Platinum Source Material Improved by New Impurity Removal Processes**
 Atsushi Kawashimo¹, Takahiro Kobayashi¹, Masatoshi Koyama², Yuichiro Shindo¹
¹*Technical Development Division, Matsuda Sangyo Co Ltd, Shinjuku-ku, Tokyo, Japan*
²*Nanomaterials Microdevices Research Center, Osaka Institute of Technology, Osaka, Japan*

SESSION 11.2: CHARACTERIZATION

- Chairs: Marty Brophy, *Consultant*
 Anita Pacheco, *Allegro MicroSystems*
- 1:00 PM **11.2.1 Defect Reduction and Yield Improvement of MIM Capacitors**
 S.A. Chevtchenko, I. Ostermay, S. Troppenz, J. Würfl, and O. Hilt
Ferdinand-Braun-Institut GmbH, Leibniz-Institut für Höchstfrequenztechnik, Berlin, Germany
- 1:20 PM *Student Presentation*
11.2.2 Mapping of Local Threshold Voltage in AlGaIn/GaN HEMTs
 Anjali Anjali¹, James Pomeroy¹, Jr-Tai Chen², Martin Kuball¹
¹*Center for Device Thermography and Reliability, H.H. Wills Physics Laboratory, University of Bristol, Tyndall Avenue, Bristol BS8 1TL, UK.*
²*SweGaN AB, Pursergatan 1, 582 78 Linköping, Sweden*
- 1:40 PM *Student Presentation*

11.2.3 Time-Dependent Conduction Mechanisms in Superlattice Layers on 200 mm Engineered Substrates

Zequan Chen¹, Peng Huang¹, Indraneel Sanyal¹, Matthew D. Smith¹, Michael J Uren¹, Anurag Vohra², Benoit Bakeroot^{2,3}, and Martin Kuball¹

¹*Center for Device Thermography and Reliability (CDTR), University of Bristol, Bristol BS8 1TL, UK*

²*Imec vzw, Kapeldreef 75, B-3001 Leuven, Belgium*

³*CMST, imec and Ghent University, Technologiepark 126, Ghent, Belgium*

2:00 PM **11.2.4 High Throughput Wafer Characterization for Manufacturing Needs of SiC and Other WBG Technologies**

M. Wilson, C. Almeida, I. Shekerov, B. Schraye, A. Savtchouk, B. Wilson and J. Lagowski

Semilab SDI, Tampa, FL, USA

2:20 PM *Student Presentation*

11.2.5 Characterization of 1.2 kV SiC Trench MOSFETs with Buried p+ Layers Using a Double-Pulse Circuit

Yeongeun Park¹, Gyuhyeok Kang¹, Sangyeob Kim¹, Hyowon Yoon¹, Soontak Kwon², and Ogyun Seok¹

¹*Kumoh National Institute of Technology, Republic of Korea*

²*KEC, Republic of Korea*

SESSION 12.0: POSTER SESSION

Chairs: Keith Wieber, Qorvo
Patrick Holly, *Northrop Grumman*
Kevin Stevens, *IQE*
Jim Crites

2:40 PM *Student Presentation*

12.0.1 Gold-free Tantalum- and Titanium-based Ohmic Contacts for Gallium Nitride HEMT Devices

Gareth Davies¹, Andrew Withey², O. J. Guy³, Jon E. Evans³, Mike Jennings³

¹ *Swansea University, Bay Campus, Crymlyn Burrows, Skewen, Swansea SA18EN,*

² *Vishay Ltd, Tower House, St Catherine's Court, Sunderland, SR53XJ*

³ *Centre for Integrative Semiconductor Materials (CISM), Bay Campus, Crymlyn Burrows, Skewen, Swansea SA18EN*

12.0.2 Enhanced Dielectric Performance of HfO₂ Thin Films Via Novel Atomic Layer Deposition Conversion at Production Speed and Efficiency

D. Lindblad, S. Harris, A. Wang, L. Mueller,
A. Dameron, M. Weimer
Forge Nano, Thornton, CO, USA

12.0.3 3D Visualization and Characterization of SiC MOSFET Junctions Using EBIC and FIB-SEM Tomography

Heiko Stegmann¹, Greg Johnson², David Tarczy², Andreas Rummel³

¹*Carl Zeiss Microscopy, Oberkochen, DE*

²*White Plains, NY, USA,*

³*Kleindiek Nanotechnik, Reutlingen, DE*

12.0.4 Sonic Lift-off (SLO) to Enable Substrate Reuse of Bulk GaN and SiC Substrates

P. Guimera Coll, T. Black, J. Abraham, S. Kamishetty, A.P. Merkle, L. Bathurst, M. Bertoni

Crystal Sonic Inc, Phoenix, AZ, USA

Student Presentation

12.0.5 Junction Termination Extensions Using P-type Epitaxial Growth Layers for 3.3 kV SiC PiN Diodes

Sangyeob Kim, Hyowon Yoon, Chaeyun Kim, Yeongeun Park, Gyuhyeok Kang, and Ogyun Seok

Kumoh National Institute of Technology, Republic of Korea

Student Presentation

12.0.6 Improving the Surge Characteristics of SiC MOSFETs by Using Poly-Si SBDs

Gyuhyeok Kang, Yeongeun Park, Hyowon Yoon, Chaeyun Kim, Sangyeob Kim and Ogyun Seok

Kumoh National Institute of Technology, Republic of Korea

Student Presentation

12.0.7 Lapping and Chemical Mechanical Polishing of Wide and Ultrawide Bandgap Semiconductors

K. Pan, K. Huynh, M. S. Goorsky
University of California, Los Angeles, CA, USA

12.0.8 Withdrawn

Student Presentation

12.0.9 Characterization of AlGaIn/GaN HEMTs on 4-inch SiC Substrate at Cryogenic Temperature

Wan-Soo Park¹, Hyeok-Jun Lee¹, Hyo-Jin Kim¹, Jae-Hak Lee¹, Kyounghoon Yang² and Dae-Hyun Kim¹

¹*School of Electronic and Electrical Engineering, Kyungpook National University (KNU), Daegu, Republic of Korea*

²*School of Electrical Engineering, Korea Advanced Institute of Science and Technology (KAIST), Daejeon, Republic of Korea,*

12.0.10 Large-Scale Thin-Film 128° Y-cut LiNbO₃ on Sapphire via Wafer Bonding

M. E. Liao¹, L. Matto², K. Huynh², N. Ravi², Y. Long², P. J. Shah¹, M. S. Goorsky²

¹*Apex Microdevices OH, USA*

²*University of California Los Angeles, Los Angeles, CA, USA*

Student Presentation

12.0.11 Pre-warning Recognition, Protective Circuit, and Failure Analysis of Red AlGaInP Light Emitting Diodes in Salty Water Vapor

Chun-Yen Yang¹, You-Li Lin², Chun-Han Chen², Mao-Tung Han², Dong-sing Wu², Yao-Wen Kuo¹, Yung-Hui Li³, Chia-Feng Lin⁴, Hsiang Chen²

¹*Department of Electrical Engineering, National Chi Nan University, Nantou 54561, Taiwan.*

²*Department of Applied Materials and Optoelectronic Engineering, National Chi Nan University, Nantou 54561, Taiwan.*

³*AI Research Center, Hon Hai Research Institute, Taipei 11494, Taiwan.*

⁴*Department of Materials Science and Engineering, National Chung Hsing University, Taichung 40227, Taiwan*

12.0.12 Towards Realization of Large-Scale β -Ga₂O₃ Composite Wafers

M. E. Liao¹, K. Huynh², N. Ravi², K. Pan², B. S. Carson², L. Matto², P. J. Shah¹, M. S. Goorsky²

¹*Apex Microdevices, West Chester, OH, USA*

²*University of California Los Angeles, Los Angeles, CA, USA*

12.0.13 Plug-n-Play SECS/GEM for Legacy Equipment

Nirav Thakkar

Einnosys Technologies LLP, USA

12.0.14 Pyramidal μ LEDs – a Novel Bottom-up Concept For Small, Bright, and Efficient Light Emitters for AR Based μ LED Projectors and Displays

I. Martinovic^{1,2}, S.P. Le^{1,2}, C.W. Hsu^{1,2}, L. Rullik¹ and P.O. Holtz^{1,2}

¹ Polar Light Technologies AB, Teknikringen 7, Sweden

² Semiconductor Physics Division, IFM, Linköping University, Sweden

Student Presentation

12.0.15 Deterioration of ZnO Nanorod Photodetectors in Saline Vapor

Geoffrey Deng-Yi Wang¹, Yi-Shiang Chiu², Sang-Hao Lin², YewChung Sermon Wu¹, Hsiang Chen², Chao-Sung Lai^{3,4}

¹ Department of Materials and Engineering Science, National Yang Ming Chiao Tung University, Taiwan.

² Department of Applied Materials and Optoelectronic Engineering, National Chi Nan University, Taiwan.

³ Department of Electronic Engineering, Chang Gung University, Taiwan.

⁴ Department of Nephrology, Chang Gung Memorial Hospital, Taiwan.

⁵ Department of Materials Engineering, Ming Chi University of Technology, Taiwan.

CONFERENCE CLOSING

3:40 PM **Accelerating Process Development for Semiconductor Device Fabrication**
Richard Gottscho, *Executive Vice President and Strategic Advisor to the CEO of Lam Research, USA*

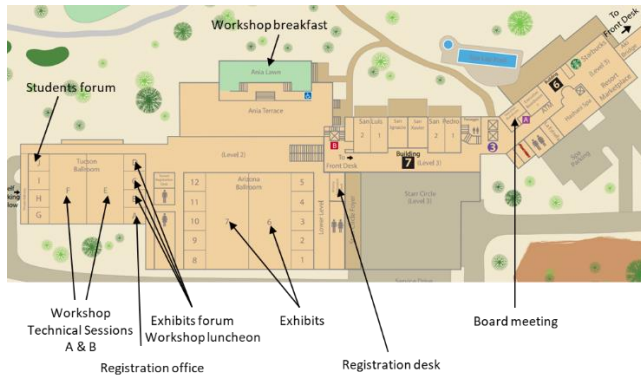
4:15 PM **Closing Reception**
David Meyer, *NRL Conference Chair*

HOTEL INFORMATION

The 2024 conference will be located at the JW Marriott Starr Pass Resort in Tucson, Arizona from Monday, May 20th to Thursday, May 23rd, 2024. The hotel is easily accessible from the Tucson International Airport (TUS) which is about 13 miles away.

JW Marriott Starr Pass Resort offers self-parking for guests and visitors in dedicated lots. Handicap parking is available at the front entrance of the hotel. Additionally, Universal Electric Vehicle Charging Stations are available at the front entrance of the hotel. Oversized vehicles, including RVs and vans, may be self-parked in a remote lot.

Uber and Lyft pickup and drop off are located right outside the hotel front door.



Hotel Floor Plan:

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