International Conference on Compound Semiconductor Manufacturing Technology

April 29th – May 2nd, 2019

www.csmantech.org

Hyatt Regency
Minneapolis, Minnesota, USA
Get the CS MANTECH App!

Search “Attendify” or scan the QR code below to take you directly to the app.

Once the Attendify app is downloaded, search for “CS MANTECH” and join the app.

For non-smart phone users, a web-based version of the app is available at TBD

Go to www.csmantech.org and click on “2019 Online Digest”.

Cover top photo taken by Dan Anderson, courtesy of Meet Minneapolis

Apple and the Apple logo are trademarks of Apple Inc., registered in the U.S. and other countries

App Store is a service mark of Apple Inc.

Google Play and the Google Play logo are trademarks of Google Inc.
MESSAGE FROM THE CONFERENCE CHAIR

On behalf of the Executive and Technical Program Committees, it is my pleasure to welcome you to Minneapolis, MN for the 34th annual International Conference on Compound Semiconductor Manufacturing Technology (CS-MANTECH). From its inception in 1986, the CS-MANTECH conference has been the only conference dedicated to featuring manufacturing-focused presentations alongside state of the art compound materials challenges and industry-leading device performance demonstrations, all within a single venue. This year the conference continues this tradition, offering a diverse technical program in compound semiconductor manufacturing, advances in materials growth and characterization, and device performance improvements. This year’s program includes traditional elements attendees have come to expect, including RF devices, process control, reliability, manufacturing, and fabrication processes. In addition, the conference features strong talks in emerging areas, including GaN and other wide bandgap devices, heterogeneous integration, power devices, and optoelectronic devices. As chair of this year’s conference, I am gratified by the opportunity to help bring together compound semiconductor professionals from around the world to share information, exchange ideas, and establish professional ties within the community.

As with all previous CS-MANTECH conferences, this year’s conference would not be possible without a tremendous amount of work from many individuals who have volunteered their time to ensure its success. I would like to thank all of the volunteers on the Technical Program Committee and the Executive Committee, along with their supporting organizations. It is the work of these individuals that enables CS-MANTECH to provide its important service to the compound semiconductor industry.

I look forward to welcoming you in person to Minneapolis, and to a successful 2019 CS-MANTECH!

Patrick Fay
University of Notre Dame
Conference Chair
CONFERENCE AT A GLANCE

SUNDAY, April 28th
6:00 PM – 8:00 PM  REGISTRATION
Nicollet Alcove D

7:00 PM – 9:00 PM  JEDEC JC-14.7 MEETING
St. Croix (2nd floor)

MONDAY, April 29th
7:00 AM – 7:00 PM  CS MANTECH
REGISTRATION
Nicollet Alcove D

7:00 AM – 8:30 AM  ROCS REGISTRATION
Nicollet Alcove A

7:00 AM – 8:30 AM  CS MANTECH & ROCS
WORKSHOP BREAKFAST
Nicollet D

8:15 AM – 5:15 PM  CS MANTECH WORKSHOP
Nicollet B-C

8:30 AM – 5:00 PM  ROCS WORKSHOP
Nicollet A

11:30 AM – 1:00 PM  CS MANTECH & ROCS
WORKSHOP LUNCHEON
Nicollet D

6:00 PM – 9:00 PM  EXHIBITS RECEPTION
Exhibit hall

6:15 PM – 8:55 PM  EXHIBITOR FORUM
Exhibit hall

TUESDAY, April 30th
7:00 AM – 5:00 PM  REGISTRATION
Nicollet Alcove D

7:00 AM – 8:00 AM  BREAKFAST
Exhibit hall

8:00 AM – 8:30 AM  OPENING CEREMONIES
Nicollet A-C

8:00 AM – 5:30 PM  EXHIBIT HOURS
Exhibit hall

8:30 AM – 9:30 AM  SESSION 1: PLENARY
Nicollet A-C

9:30 AM – 10:00 AM  BREAK
Exhibit hall
TUESDAY, April 30th continued

10:00 AM – 12:00 PM  SESSION 1: PLENARY
                      Nicollet A-C

12:00 PM – 1:30 PM  EXHIBITS LUNCH
                      Exhibit hall

1:00 PM – 5:10 PM  EXHIBITOR FORUM
                      Exhibit hall

1:30 PM – 3:10 PM  SESSION 2: 5G
                      Nicollet A

1:30 PM – 3:10 PM  SESSION 3: MANUFACTURING CULTURE
                      Nicollet B-C

3:10 PM – 3:40 PM  BREAK
                      Exhibit hall

3:40 PM – 5:40 PM  SESSION 4: RF DEVICES AND FILTERS
                      Nicollet A

3:40 PM – 5:40 PM  SESSION 5: GaAs PROCESS CONTROL & YIELD
                      Nicollet B-C

5:45 PM – 6:45 PM  STUDENT FORUM
                      Lakeshore C

7:00 PM – 10:00 PM  INTERNATIONAL RECEPTION
                      Minneapolis Institute of Art

WEDNESDAY, May 1st

7:00 AM – 5:00 PM  REGISTRATION
                      Nicollet Alcove D

7:00 AM – 8:00 AM  BREAKFAST
                      Exhibit hall

8:00 AM – 11:00 AM  EXHIBIT HOURS
                      Exhibit hall

8:00 AM – 10:00 AM  SESSION 6: POWER ELECTRONICS PLENARY
                      Nicollet B-C

10:00 AM – 10:30 AM  BREAK
                      Exhibit hall

10:30 AM – 12:00 PM  SESSION 7: WIDE BANDGAP POWER DEVICES
                      Nicollet B-C
WEDNESDAY, May 1st continued

10:30 AM – 12:10 PM  SESSION 8:  
                      HETEROGENEOUS INTEGRATION & PROCESSING  
                      Nicollet A

12:15 PM – 1:30 PM   OPEN  
                      Lunch on your own with a little time to explore Minneapolis

1:30 PM – 3:20 PM  SESSION 9: GaN LATERAL POWER DEVICES  
                      Nicollet B-C

1:30 PM – 3:30 PM  SESSION 10: DEVICE PROCESSING I  
                      Nicollet A

3:30 PM – 4:00 PM   BREAK  
                      Nicollet Promenade

4:00 PM – 5:40 PM  SESSION 11: TEST & CHARACTERIZATION – CS DEVICES  
                      Nicollet B-C

4:00 PM – 5:40 PM  SESSION 12: DEVICE PROCESSING II  
                      Nicollet A

6:00 PM – 8:00 PM   RUMP SESSIONS  
                      Nicollet D & Lakeshore A-C

8:00 PM – 9:00 PM   SEMI STANDARDS MEETING  
                      St. Croix (2nd floor)

THURSDAY, May 2nd

7:00 AM – 9:30 AM  REGISTRATION  
                      Nicollet Alcove D

7:00 AM – 8:00 AM   BREAKFAST  
                      Nicollet B-C

8:00 AM – 10:00 AM  SESSION 13: OPTOELECTRONICS PLENARY  
                      Nicollet B-C

10:00 AM – 10:30 AM  BREAK  
                      Nicollet Promenade

10:30 AM – 12:20 PM  SESSION 14: VCSEL  
                      Nicollet B-C
THURSDAY, May 2nd continued

10:30 AM – 12:10 PM  SESSION 15: TEST & CHARACTERIZATION OF WIDE BANDGAP HETEROSTRUCTURES
                      Nicollet A

12:20 PM – 1:30 PM  CS MANTECH LUNCH
                      Nicollet B-C

1:30 PM – 3:30 PM  SESSION 16: PROCESS AND YIELD
                       Nicollet B-C

1:30 PM – 3:30 PM  SESSION 17: MATERIALS AND GROWTH FUNDAMENTALS
                       Nicollet A

3:40 PM – 4:30 PM  SESSION 18: POSTER SESSION
                       Lakeshore ballroom

4:30 PM – 5:30 PM  CLOSING RECEPTION
                       Lakeshore ballroom

6:00 PM – 8:00 PM  CoInnovateCS Networking Reception
                       https://www.coinnovatecs.com

FRIDAY, May 3rd

8:00 AM – 8:30 AM  CoInnovateCS Registration
                       https://www.coinnovatecs.com

8:30 AM – 1:15 PM  CoInnovateCS
                       https://www.coinnovatecs.com
2019 CONFERENCE HIGHLIGHTS

On behalf of the Technical Program Committee for the 2019 CS MANTECH Conference, I thank you for participating in this year’s program. We have an excellent conference planned and I am sure you will find many enlightening and informative talks and sessions for your enjoyment and edification.

CS MANTECH has its roots in the application of compound semiconductors for RF devices. This year we broaden the scope beyond RF into other compound semiconductor markets and are introducing a plenary session for each day. On Tuesday we will have a classic CS MANTECH plenary session. On Wednesday we will have our first dedicated CS MANTECH Power electronics plenary session followed by our CS Optoelectronic plenary session on Thursday. Both dedicated plenary sessions are comprised of a keynote and invited talks.

Another new feature this year is that we are co-located with CoInnovateCS (https://coinnovatecs.com) which is being held in the US for the first time. CoInnovateCS promises to offer an interactive one day event fostering innovation across the compound semiconductor supply chain, by exploring industry-led next generation challenges and opportunities.

Here are the highlights for the program:

Sunday, April 28th

- This year we are introducing our inaugural invitational Golf Tournament (weather permitting). More details can be found on our website and mobile app. Please check in frequently.

Monday, April 29th

- The program begins this year with our series of tutorial workshops. This year’s workshop theme is “Fabrication Potpourri.” Please see the CS MANTECH WORKSHOP section for details.
- Also, on Monday CS MANTECH is pleased to be hosting the internationally recognized Reliability of Compound Semiconductor (ROCS) workshop. This workshop is the premier forum for the presentation of the latest results and new developments related to compound semiconductor reliability. The JEDEC Committee JC-14.7 sponsors the ROCS workshop. Please see http://www.jedec.org/home/gaas for details.
- On Monday evening, the Exhibits open at 6:00 pm with the traditional Exhibits Reception. The CS MANTECH exhibits are an excellent opportunity to view suppliers of materials, services, and equipment from around the world. This is also a great time to reconnect with your friends and establish new
connections to identify new opportunities and help grow your success.

- At 6:15pm we will open the Exhibitor forum in the Exhibit hall. The Exhibitors’ Forum provides an opportunity for exhibitors to present short marketing/technical presentations to the conference attendees.

**Tuesday, April 30th**

- The CS MANTECH Conference formally begins in the morning at 8:00 am with opening ceremonies that include the 2018 Best Paper awards, sponsorship recognition, and a conference overview along with a review of the conference mobile app. Please see the mobile app section for details.

- Following the opening ceremonies, we will have our traditional plenary session, which features three talks covering a wide spectrum of CS Industry topics. Tom Deitrich from Itron will give his perspective on the solutions and needs of IoT, utilities, and smart cities. Wayne Lam from IHS Markit will reflect on how mobile use cases dictates electronic design and Andrew Barnes from the European Space Agency will report on the first ESA missions to use gallium nitride (GaN).

- After lunch in the Exhibits Hall, we will reconvene for a full program of parallel sessions throughout the afternoon. Parallel sessions have been structured so that attendees can move between talks and sessions, with minimal overlap between the parallel sessions.

- We will also continue our Exhibitor forum in the Exhibit hall throughout the afternoon.

- The Tuesday technical session will conclude with the Student Forum. The Student Forum provides an opportunity for students to explore career options through networking with members of the CS community from industry, academia, and government.

- In the evening, CS MANTECH will host the International Reception (IR) at the Minneapolis Institute of Art. This annual event has been a fun and memorable highlight of past conferences and we anticipate an exciting evening again this year.

**Wednesday, May 1st**

- For a mid-week rejuvenator, join us in the morning at 6:00 am for a non-competitive run or walk along the Loring Greenway through Loring Park. More details can be found on our website.

- Wednesday morning begins with breakfast in the Exhibitor Hall where attendees can follow up on questions from the Exhibitors’ Forum or meet with one or two new vendors.

- We will open the technical program on Wednesday with our first dedicated Power Electronics plenary at 8:00 am. John Palmour from Wolfspeed will focus on the current status of SiC materials and devices for use...
in power applications. Dr. Koji Shiozaki from Nagoya University will present a new mobility concept called all GaN vehicles (AGV), and Dr. Frank Wischmeyer from Aixtron reviews the latest developments of epitaxy production technology for SiC and GaN.

- Following the morning break, a full program of parallel sessions will take place throughout the day.
- Lunch will be at your own leisure (or time to explore Minneapolis), with parallel sessions continuing in the afternoon starting at 1:30 pm.
- We will close the day with our traditional Rump session starting at 6:00 pm with a reception. Please see the Rump Session section for details.
- At 8:00 pm the SEMI Standard Meeting will be held.

**Thursday, May 2nd**

- On Thursday, we will open the technical program with our first dedicated Optoelectronics plenary at 8:00 am. Chuck Mattera from II-VI will provide an overview and perspective on vertical-cavity-surface-emitting-lasers (VCSELs). Fred Kish of Infinera Corporation will discuss key elements of success for volume manufacturing of InP based photonic integrated circuits, and Eric Virey of Yole Développement will present on the hype, reality, hopes and challenges of MicroLED displays.
- Following the morning break, we will continue with parallel sessions.
- At noon, all conference attendees are invited to join us for the CS MANTECH conference luncheon.
- After lunch, we will hold our last two parallel sessions followed by the poster session. The closing reception features prizes for the conference contest (best semiconductor joke or meme), as well as for best poster and conference feedback. We will also have a special guest, John DeBoer (http://www.johndeboer.com). Come see the posters, join the contest, and enjoy our conference closing reception.
- CoInnovateCS open its doors at 6:00pm (please see https://coinnovatecs.com for more details and registration information)

Thank you again for being part of this year’s conference and welcome to Minneapolis!

**Thorsten Saeger**  
Qorvo  
Technical Program Chair  
2019 CS MANTECH
2019 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 2019 CS MANTECH Conference Committee gratefully acknowledges the support from our sponsors.

(Sponsor list as of 3/11/19)

**Platinum Sponsors:**
- Skyworks Solutions, Inc.
- Wolfspeed, A Cree Company
- Plasma-Therm, LLC
- The MAX Group
- Accel-RF Instruments Corporation
- Sumitomo Electric

**Gold Sponsors:**
- Northrop Grumman
- Virginia Diodes, Inc.
- Revasum
- Ampleon
- WIN Semiconductors Corp.
- LAM Research
- Brewer Science, Inc.
- Itochu Plastics Inc.
- Sumika Electronic Materials
- MACOM Technology Solutions Inc.
- SCIOCS

**Silver Sponsors:**
- AIXTRON
- Orbotech/SPTS Technologies

**Media Sponsors:**
- i-Micronews (powered by Yole Développement)
- Microwave Journal
- Compound Semiconductor Magazine
The theme of this year’s workshop is “Fabrication Potpourri”.  

The technology that we use and produce in our day-to-day work lives is constantly changing. This year's workshop will take some time to refresh some basic skills and knowledge of value to the semiconductor engineer and also look forward to opportunities for the industry.  

The morning talks will focus on changing trends in semiconductor foundry operations and process optimization. The first talk comes from SkyWater Technology Foundry. Tom Legere, the Senior Vice President of Operations, will discuss how to manage a high mix technology foundry in the age of “more than Moore.” The following extended talk from Joseph Holyoak at Qorvo will provide an overview of Six Sigma (6σ) practices describing how statistical analysis and proper design of experiments (DOEs) can be used for process optimization and to ensure high quality of output.  

Shifting focus, the afternoon workshop talks will begin with discussions on emerging opportunities for the compound semiconductor industry. Michael O’Neal, Senior Director of Design and Advanced Engineering at Qorvo, will provide an overview of 5G networks and the role compound semiconductor technologies can play. The next workshop talk comes from Dr. Dennis Deppe of sdPhotonics in which he will discuss vertical-cavity surface-emitting lasers (VCSELs). Various VCSEL technologies will be described along with market drivers and applications.  

Following the afternoon break, the final talk of the day will be jointly presented with the Reliability of Compound Semiconductors (ROCS) workshop. Dr. Mike Salmon, a Scientific Fellow from EuroFins-EAG, will discuss destructive physical analysis (DPA) describing various imaging and analytical techniques. Methodologies for determination of underlying root cause in unique failures addressed through multi-technique case studies will be presented.
2019 ROCS WORKSHOP

Reliability Of Compound Semiconductors

April 29th, 2019
8:30 AM – 5:00 PM

The 35th annual ROCS Workshop will be held in conjunction with the CS MANTECH Conference on Monday April 29th, 2019, at the Hyatt Regency Minneapolis in Minneapolis, Minnesota, USA. This workshop is sponsored by the JEDEC JC-14.7 Committee on GaAs Reliability and Quality Standards. The ROCS Workshop brings together researchers, manufacturers and users of compound semiconductor materials, devices and circuits. Papers presenting latest results, including work-in-progress and new developments in all aspects of compound semiconductor reliability will be presented.

2019 CoInnovateCS

Friday, May 3rd, 2019
8:00 AM – 1:15 PM

Held in the US for the first time and co-located with CS-MANTECH in Minneapolis, CoInnovateCS provides a unique opportunity to collaborate with experts in compound semiconductor manufacturing. CoInnovateCS is a unique and intense interactive one day event fostering innovation across the compound semiconductor supply chain, by exploring industry-led next generation challenges and opportunities. This year’s CoInnovateCS event will focus on emerging trends across the compound semiconductor industry. The conference promises an agenda with engaging activities, including inspirational talks, panel sessions, technology pitches and CoSynergy workshops where we will explore challenges and opportunities in a more innovative and collaborative way. More details can be found online: https://coinnovatecs.com/
INDUSTRY EXHIBITS

2019 will continue the CS MANTECH tradition of holding a robust exhibits program in parallel with the technical conference to facilitate interactions and exchange amongst members of the compound semiconductor industry. Exhibitors spanning the full range of materials, equipment, and services relevant to the compound semiconductor industry will be on hand to interact with conference attendees. Vendors of substrates, process gas and specialty material suppliers, fabrication, inspection and test equipment providers, technical and manufacturing consulting services, and industrial publication venues will be there.

To facilitate interactions between exhibitors and attendees, an Exhibits Reception will be held on Monday evening, April 29th, in the exhibition hall. The exhibits will also be open all day Tuesday, April 30th through Wednesday morning, May 1st until 11:00 AM, with breakfasts, coffee breaks, and lunch on Tuesday during the conference all taking place in the exhibition hall. Additionally, a series of Exhibitor Forum events will take place on Monday from 6:15 PM – 8:55 PM and Tuesday from 1:00 PM to 5:10 PM in the Exhibit Hall. These events provide participating exhibitors an opportunity to more fully showcase their products and services.

2019 EXHIBITORS

Advanced Compound Semiconductors Beijing Co.
AIXTRON
ANNEALSYS
ASAP AXR
Beneq
Bruker Semiconductor Division
C&D Semiconductor
Canon USA
ClassOne
CS CLEAN SOLUTIONS Inc
DISCO Hi-Tec Americ, Inc.
DOWA ELECTRONICS MATERIALS CO., LTD.
EAG Laboratories
Engis Corporation
ePAK International, Inc.
EpiGaN
Evatec AG
FRT of America
Fujimi Corp
GT Advanced Technologies
Hi-Solar Co., Ltd.
II-VI Advanced Materials
II-VI EpiWorks
Innovion Corporation
Insaco, Inc
Intelligent Epitaxy Technology Inc.
IQE plc
JEOL USA, INC
k-Space Associates, Inc  
LayTec  
Matheson Tri-Gas, Inc.  
MEI Wet Process  
MicroChem Corp  
Microtronic Inc.  
MSE Supplies  
Nanotronics  
Nel Hydrogen  
Oxford Instruments - Plasma Technologies  
Plasma-Therm  
R2D Automation  
Reedholm Systems  
Revasum  
Samco, Inc.  
Semilab  
SGL Carbon  
Shin-Etsu MicroSi  
SPTS Technologies  
StratEdge Corporation  
Sumitomo Chemical Advanced Technologies  
Vacuum Engineering & Materials  
Veeco  
Virginia Diodes Inc.  
Visual Photonics Epitaxy Co., Ltd  
Vital Materials Co., Limited  
Wafer World Inc.  
Wolfspeed, A Cree Company  
Yield Engineering Systems, Inc.

**INTERNATIONAL RECEPTION**

On Tuesday, April 30th evening, CS MANTECH will host the International Reception. This annual event has been a fun and memorable highlight of past conferences and we anticipate an exciting evening again this year. This year the International Reception will be held at the Minneapolis Institute of Art (MIA). Join us to socialize with your colleagues and experience diverse art from around the world. (https://new.artsmia.org/).
SEMI STANDARDS MEETING

The SEMI Standards meeting is scheduled for Wednesday May 1st, from 8:00 pm to 9:00 pm in the St. Croix meeting room on the 2nd floor. The SEMI Compound Semiconductor (GaAs, InP and SiC) Committee invites CS MANTECH Conference attendees interested in the development of internationally approved standards for wafer specifications to attend this meeting. Topics being addressed are GaAs, InP, and SiC dimensions/orientations and electrical properties, epitaxial layer specifications (which properties should be specified, and how they are to be verified), and non-destructive test methods.

Based in Milpitas, CA, SEMI is an international trade association serving more than 2,400 companies participating in the semiconductor and flat panel display equipment and materials markets. SEMI maintains offices in Berlin, Grenoble, Tokyo, Seoul, Hsinchu, Shanghai, Singapore, Bangalore, and Washington, DC. For additional information, please contact: Co-Chair: James Oliver of Northrop Grumman at 410-765-0117 or j.oliver@ngc.com, Co-Chair: Russ Kremer of Freiberger Compound Materials at 937-291-2899 or russ@fcm-us.com, or at SEMI Standards contact Kevin Nguyen at 408-943-7997 or knguyen@semi.org.

CS MANTECH CONFERENCE CONTEST

The conference contest this year will test both your wit and semiconductor knowledge. The goal is to submit your best (clean) semiconductor meme or joke. The best entry wins a prize and is shared at the conference closing. Good luck!

2019 CS MANTECH ONLINE DIGEST

CS MANTECH will again be offering an online digital version of the conference technical proceedings. Digital copies of the papers presented at the 2019 International Conference on Compound Semiconductor Manufacturing Technology will be available for download and viewing from our online site during the conference. Printed 2019 digests were offered to attendees who requested a copy at the time of conference registration and if registration was completed by the early registration deadline, April 5th.

To access the 2019 online digest, go to www.csmantech.org and click on “2019 Online Digest”.

16  2019 CS MANTECH Conference Guide
2018 EXECUTIVE COMMITTEE

Chairman Emeritus
He Bong Kim, GaAstronics

Conference Chair
Patrick Fay, University of Notre Dame

Technical Program Chair
Thorsten Saeger, Qorvo

Publication Chair
David Meyer, Naval Research Laboratory

Local Arrangements Chair
Shawn Burnham, HRL Laboratories, LLC

Local Arrangements Vice-Chair
Jansen Uyeda, Northrop Grumman

Treasurer
Paul Cooke, IQE

Exhibits Chair
Kelli Rivers, Vacuum Engineering & Materials

Workshop Chair
David Via, AFRL; Gerhard Schoenthal, VDI

Communications & Publicity Chair
Guoliang Zhou, Skyworks Solutions

Sponsorship Chair
Don Gajewski, Wolfspeed, a Cree Company

International Liaisons
Europe: Hermann Stieglauer, UMS
Asia: Chang-Hwang Hua, Win Semiconductors Corp.

Registration Chair
Martin Kuball, University of Bristol

Web, App, & Feedback Chair
Andy Souzis, II-VI Advanced Materials

University Liaison
Yohei Otoki, SCIOCS

International Reception Chair
Shalini Gupta, Northrop Grumman ES

Information Chair
Hermann Stieglauer, UMS

Budget Chair
Rüdiger Schreiner

Audio Visual Chair
Peter Ersland, MACOM Technology Solutions

Committee Members
Travis Abshere, nLight
Scott Davis, Sumitomo Electric
Michelle Bourke, Lam Research Corp.
Marty Brophy
Celicia Della-Morrow, Qorvo
Drew Hansen, Veeco
Mariam Sadaka
Alex Smith, Brewer Science, Inc
Naveen Tipirneni, Texas Instruments
2019 BOARD OF DIRECTORS

Board of Directors Chair
Glen “David” Via, Air Force Research Laboratory

Secretary
Travis Abshere, nLight

Treasurer
Paul Cooke, IQE

Board Members
Marty Brophy
Scott Davis, Sumitomo Electric
Celicia Della-Morrow, Qorvo
Peter Ersland, MACOM Technology Solutions
Drew Hanser, Veeco
Mariam Sadaka
Chris Santana, IQE
Scott Sheppard, Wolfspeed, a Cree Company
Alex Smith, Brewer Science, Inc

TECHNICAL PROGRAM COMMITTEE

Travis Abshere, nLight
Zaher Bardai, IMN.EPIPHANY, Technology Business Consulting
John Blevins, Air Force Research Laboratory
Karlheinz Bock, TU Dresden
Michelle Bourke, Lam Research Corp.
Marty Brophy
Shawn Burnham, HRL Laboratories, LLC
Doug Campbell, ePAK International, Inc
Andy Carter, Teledyne Scientific and Imaging
Kezia Cheng, MACOM Technology Solutions
Paul Cooke, IQE
Jim Crites, Blue Ridge Semiconductor, LLC
Scott Davis, Sumitomo Electric
Celicia Della-Morrow, Qorvo
Nicholas Dellas, Texas Instruments
Andreas Eisenbach
Peter Ersland, MACOM Technology Solutions
Mario Faria, MAX I.E.G.
Patrick Fay, University of Notre Dame
Milton Feng, University of Illinois
Don Gajewski, Wolfspeed, A Cree Company
Andrew Green, Air Force Research Laboratory
Shalini Gupta, Northrop Grumman
Drew Hanser, Veeco Instruments, Inc.
Quesnell Hartmann, II-VI EpiWorks
Haldane Henry, Qorvo
Fumimasa Hwang, WIN Semiconductors Corp.
Martin Huber, Infineon Technologies Austria AG
Serge Karboyan, University of Bristol
Hidetoshi Kawasaki, Sony Semiconductor Solutions
Nick Kolarich, II-VI EpiWorks
Russell Kremer, Freiberger Compound Materials
Judy Kronwasser
Martin Kuhall, University of Bristol
Sarang Kulkarni, Skyworks Solutions
Barbara Landini, Sunika Electronic Materials
Chun-Lim Lau, Booz Allen Hamilton
Jeffrey Laroche, Raytheon
Randy Lewis, Northrop Grumman
Technical Program Committee - continued

Chuanxin Lian, Qorvo
Chuck Liu, San’an-IC
Shenghou Liu, San’an-IC
Earl Lum, EJL Wireless Research
Steve Mahon, Feldman Engineering
David Meyer, Naval Research Laboratory
    Greg Mills, AXR
Peter Moens, ON Semiconductor
    Bobb Mohondro, S-cubed
Karen Moore, NXP Semiconductors
    Stephen Myers, Lumentum
    Mitsuhiko Nakamura, Sony
    Corey Nevers, Qorvo
    Yogi Ota, Duet RF Solutions
    Yohei Otoki, SCIOCS
    Anita Pacheco, Qorvo
Paul Pinsukankanjana, IntelliEPI
    Fabian Radulescu, Wolfspeed, A Cree Company
    Karen Renaldo, Northrop Grumman
Kelli Rivers, Vacuum Engineering & Materials Co.
    Thomas Roedle, Ampleon
    Mariam Sadaka
    Robert Sadler, MACOM Technology Solutions
    Thorsten Saeger, Qorvo
    Chris Santana, IQE
Gerhard Schoenthal, Virginia Diodes, Inc.
    Rüdiger Schreiner, Consultant
    Shyh-Chiang Shen, Georgia Tech
Scott Sheppard, Wolfspeed, A Cree Company
    Alex Smith, Brewer Science, Inc.
    Andy Souzis, II-VI Advanced Materials
Joerg Splettstoesser, United Monolithic Semiconductor GmbH
    Christopher Stender, MicroLink Devices, Inc.
    Kevin Stevens, IQE
Susan Stevens, Analog Devices, Inc.
    Eric Stewart, Northrop Grumman
Hermann Stieglauser, United Monolithic Semiconductor GmbH
    Mike Sun
    Jim Tatum, Photon Sciences
    Shiban Tiku, Skyworks Solutions
    Naveen Tipirneni, Texas Instruments
    Matthew Tyhach, Raytheon
    Jansen Uyeda, Northrop Grumman
    Kevin Vargason, IntelliEPI
Glen “David” Via, Air Force Research Laboratory
    David Wang, Global Communication Semiconductors, LLC
    Russ Westerman, Plasma-Therm LLC
    Keith Wieber, Qorvo
    Walt Wohlmuth, Win Semiconductors Corp.
    Barry Wu, Keysight Technologies
    Takuji Yamamura, Sumitomo Electric
    Wei Zhang, AXT
    Guoliang Zhou, Skyworks Solutions
    Heribert Zull, OSRAM Opto Semiconductors GmbH
TECHNICAL PROGRAM

Monday, April 29th

CS MANTECH WORKSHOP
“Fabrication Potpourri”

Chairs: Gerhard Schoenthal, Virginia Diodes
       Glen “David” Via, Air Force Research Laboratory

7:00 AM  REGISTRATION
7:30 AM  WORKSHOP BREAKFAST
7:50 AM  WELCOME AND INTRODUCTIONS
8:00 AM  Making Moore Happen: Managing a High Mix Technology Foundry
         Tom Legere, SkyWater Technology Foundry
9:00 AM  6σ – What it is and how to use it
         Joseph Holyoak, Qorvo
10:00 AM BREAK
10:30 AM 6σ – What it is and how to use it
         (continued)
         Joseph Holyoak, Qorvo
12:00 PM WORKSHOP LUNCH
         (CS MANTECH & ROCS)
1:00 PM  5G: Changing the way we work, live and play
         Michael K O’Neal, Qorvo
2:00 PM  Oxide and Oxide-Free VCSELs for High Market Volume Manufacturing and New Applications
         Dennis Deppe, sdPhotonics LLC
3:00 PM  BREAK
3:30 PM  Advanced Failure Analysis of Compound Semiconductors
         Mike Salmon, EuroFins-EAG
4:30 PM  WRAP UP
6:00 PM  EXHIBITS RECEPTION
Monday, May 29th

ROCS WORKSHOP

AGENDA TBD
Tuesday, April 30th

CONFEERENCE OPENING
Location: Nicollet A-C

8:00 AM Opening Ceremonies
Patrick Fay, Conference Chair
University of Notre Dame

8:10 AM 2018 Conference Best Paper Awards
Patrick Fay, Conference Chair
University of Notre Dame

8:20 AM Technical Program Highlights
Thorsten Saeger, Technical Program Chair
Qorvo

SESSION 1: PLENARY
Location: Nicollet A-C
Chairs: Patrick Fay, University of Notre Dame
Thorsten Saeger, Qorvo

8:30 AM Invited Presentation
1.1 A Perspective on the Solutions and Needs of IoT, Utilities, and Smart Cities
Tom Detrich
Itron

9:30 AM BREAK

10:00 AM Invited Presentation
1.2 Form follows function: Mobile use-cases dictates electronic design, not the other way around
Wayne Lam
HIS Markit – Technology, Media & Telecom

11:00 AM Invited Presentation
1.3 First ESA missions to use gallium nitride (GaN) – a disruptive technology for space based payloads
Andrew Barnes
European Space Agency

12:00 PM EXHIBITS LUNCH
Exhibits Hall
Tuesday, April 30th

SESSION 2: 5G
Location: Nicollet A
Chairs: Takuji Yamamura, Sumitomo Electric
Yogi Ota, Duet RF Solutions

1:30 PM Invited Presentation
2.1 5G Implications for the Compound Semiconductor Industry
Earl J. Lum
EJL Wireless Research LLC

2:00 PM Invited Presentation
2.2 How Will 5G Influence the RF Compound Semiconductor Industry?
Eric Higham
Strategy Analytics

2:30 PM 2.3 Development of InP DHBTs with High Breakdown Voltage for Ka-Band PA Applications
Yuefei Yang1, Dheeraj Mohata1, David Rasbot1, R. Soligo1, David Wang1,
Robert Bayruns2, John Bayruns2, David Osika2 and Joseph Brand2
1Global Communication Semiconductors, LLC.
2Duet Micro Electronics, Inc.

2:50 PM 2.4 5G impact on mobile RF Front End
Ezgi Dogmus, Cédric Malaquin and Claire Troade
Yole Développement

3:10 PM BREAK
Tuesday, April 30th

SESSION 3: MANUFACTURING CULTURE

Location: Niccolot B-C
Chairs: Keith Wieber, Qorvo
       Sarang Kulkarni, Skyworks Solutions

1:30 PM  Invited Presentation
         3.1 Complexity vs. Continuous Process Improvement
               Gad (Gadi) Dvir
               Strategy Implementation LLC Managing Member

2:00 PM  3.2 Fast Throughput Improvement
             Through Speed Modeling Using Tool Matching and Process Optimization
               Marino Arturo
               The MAX Group

2:20 PM  3.3 Improving Root Cause Analysis
             Accuracy Using Advanced Sensor Trace Analytics
               Michael Zhao¹, Kim Kok Gan²
               ¹Global Foundries, ²BISTel America

2:40 PM  Invited Presentation
         3.4 Implementation of Automated Process Dashboards
               Jens Riege, Donnie Lee, Rainier Lee, Nercy Ebrahimi
               Skyworks Solutions, Inc.

3:10 PM  BREAK
Tuesday, April 30th

SESSION 4: RF DEVICES AND FILTERS
Location: Nicollet A
Chairs: Haldane Henry, Qorvo
Serge Karboyan, University of Bristol

3:40 PM Invited Presentation
4.1 Dynamic Range-enhanced Electronics and Materials
Young-Kai Chen
Defense Advanced Research Projects Agency

4:00 PM 4.2 Investigation of RF Performance of InGaP/GaAs HBT Power Stage with Flip-Chip Bumping Technology
Fan-Hsiu Huang, Jung-Hao Hsu, Tung-Yao Chou, Shu-Hsiao Tsai, Cheng-Kuo Lin,
Dennis Williams, and Yu-Chi Wang
WIN Semiconductors Corp.

4:30 PM Invited Presentation
4.3 Epitaxial material for RF filters
Andrew Clark¹, Rytis Dargis¹, Mukul Debnath¹,
Robert Yanka¹, Rich Hammond², Rodney Pelzel³,
Mingyo Park⁴, Azadeh Ansari⁴
¹IQE NC
²IQE Silicon
³IQE PA
⁴Georgia Institute of Technology

4:50 PM 4.4 Monolithic integration of surface acoustic wave (SAW) filters on GaN HEMT dies:
Avoiding impedance matching through energy trapping
Stefano Valle¹, Manikant Singh², Martin Cryan¹,
Martin Kuball², and Krishna C. Balram¹
¹University of Bristol
²Centre for Device Reliability and Thermography, University of Bristol

5:20 PM Student Presentation
4.5 High-quality AlN/sapphire-based Surface Acoustic Wave Filter With 5.75 dB Insertion Loss
Qiong Feng¹, Yun Zhang¹, Shuai Yang¹,
Yujie Ai¹, Zhe Cheng¹, Lian Zhang¹, Lifang Jia¹, Boyu Dong², Baohui Zhang³
¹Institute of Semiconductors, Chinese Academy of Sciences
²NAURA Technology Group Co., Ltd
Tuesday, April 30th

SESSION 5: GaAs PROCESS CONTROL & YIELD
Location: Nicollet B-C
Chairs: Marty Brophy
        Susan Stevens, Analog Devices, Inc.

3:40 PM  5.1 High-Volume pHEMT Yield Improvement Through Mitigation of Incomplete Removal of InGaP
Robert Waco, Yiping Wang, Chang’e Weng,
David Punsalan, Ron Herring
Qorvo

4:00 PM  5.2 A Systematic Data Mining Approach to separate Epitaxial Impacts from Process Impacts for GaAs pHEMT Technologies
Peter Gretz, Franck Bourgeois, and Michael Hosch
United Monolithic Semiconductors GmbH

4:20 PM  5.3 Modelling of Backside-induced ESD Defects in GaAs Front End Manufacturing
Michael Hosch, Raphael Ehrbrecht, Markus Lanz, Holger Weiner, and Dag Behammer
United Monolithic Semiconductors GmbH

4:40 PM  5.4 Addressing 0.25 um T-Gate Lithography Defects through Data Driven Fit Model Analysis
Monique Farrell, Kai Shin, Brittany Janis, Kevin Frey, John Mason, Gary Hughes, Christopher Ridpath, Megan Snook, Aditya Gupta, H. George Henry, David Lawson, Jim Arnold, Josephine Chang, Eric Seabron
Northrop Grumman Corporation

5:00 PM  5.5 Gold Electroplating Optimization in Diffusion-Limited Regime
Vinh Ho, Justin van Staden, Rainier Lee and Daniel Weaver
Skyworks Solutions, Inc.

5:20 PM  5.6 Investigation of MIM Top Metal Peeling in Relation to Transitional Flow during Metal Deposition Process
Chang’e Weng, Tertius Rivers, Moreen Minkoff, Ron Herring, Richard Ducusin, Jinhong Yang and Joseph Chinn
Qorvo

5:45 PM  STUDENT FORUM

7:00 PM  INTERNATIONAL RECEPTION
Minneapolis Institute of Art
Wednesday, May 1st

SESSION 6: POWER ELECTRONICS PLENARY
Location: Niccollet B-C
Chairs: Naveen Tipirneni, Texas Instruments
       Martin Kuball, University of Bristol

8:00 AM Invited Presentation
6.1 Current Status of SiC Materials and Devices for use in Power Applications
John Palmour
Wolfspeed, A Cree Company

9:00 AM Invited Presentation
6.2 GaN-based Electrified Mobility for Sustainable Society
Koji Shiozaki¹, Y. Nakayama¹, Y. Kanazawa²
¹Nagoya University, ²Naturanix Co.

9:30 AM Invited Presentation
6.3 Epitaxy production technologies enabling next generation product roadmaps of wide band-gap semiconductor device industry
Frank Wischmeyer
AIXTRON SE

10:00 AM BREAK

SESSION 7: WIDE BANDGAP POWER DEVICES
Chairs: Don Gajewski, Wolfspeed, A Cree Company
       Martin Huber, Infineon Technologies Austria AG

10:30 AM Invited Presentation
7.1 Advances in Vertical GaN Power Devices on GaN Substrates
K. Yasunishi, G. Nishio, S. Murakami, and N. Murakami
TOYODA GOSEI Co., Ltd.

11:00 AM Invited Presentation
7.2 Accelerating Commercialization of Wide-Bandgap Power Electronics – The Power America Manufacturing Initiative
Victor Veliadis
North Carolina State University
**Wednesday, May 1st**

11:30 AM  *Invited Presentation*

7.3 SiC Power MOSFET Manufacturing, Performance and Reliability for the Electric Vehicle Market


*Wolfspeed, A Cree Company*

**SESSION 8: HETEROGENEOUS INTEGRATION AND PROCESSING**

Location: *Nicollet A*

Chairs: Hermann Stieglauer, *United Monolithic Semiconductor GmbH*
Greg Mills, *AXR*

10:30 AM  *8.1 Layer transfer of high-voltage, GaN-on-GaN pn diodes through epitaxial lift-off*

Chris Youtsey¹, Robert McCarthy¹, Rekha Reddy¹, Andy Xie², Ed Beam², Lou Guido³, Jingshan Wang⁴, and Patrick Fay⁴

¹MicroLink Devices, Inc, ²Qorvo
³Virginia Tech, ⁴University of Notre Dame

10:50 AM  *Invited Presentation*

8.2 Heterointegration of III-V Device Structures on Si Substrates via Direct MBE Growth

A. W. K. Liu¹, D. Lubyshch¹, J. M. Fastenau¹, M. Fetters¹, H. Kryski¹, J. Zeng¹, M. Kattner¹, P. Frey¹, S. A. Nelson¹, X.-M. Fang¹, A. O. Morgan², S. A. Edwards², and M. J. Furlong³

¹IQE PA, ²IQE Silicon, ³IQE IR

11:20 AM  *8.3 GaN quasi-MMIC HPAs with IPDs on HRS using via first TSV process*

Sangmin Lee, Seokgyu Choi, Ho Geun Lee, Sung Won Lee, Young Jae Kim, Min Han, and Jinman Jin

*Wavice Inc.*

11:40 AM  *Invited Presentation*

8.4 CMP Process Development on III-V Substrates for 3D Heterogeneous Integration

Miguel Urteaga¹, Andrew Carter¹, Sangki Hong², Robert Patti², Carl Petteway², Gill Fountain²

¹Teledyne Scientific & Imaging
²NHanced Semiconductors Inc.

12:15 PM  *OPEN*

Lunch on your own
Wednesday, May 1st

SESSION 9: GaN LATERAL POWER DEVICES
Location: Nicollot B-C
Chairs: Nicholas Dellas, Texas Instruments
Mitsuhiro Nakamura, Sony

1:30 PM Invited Presentation
9.1 AlGaN/GaN Power Devices in a Si World: From R&D to Manufacturing and Reliability
P. Moens, P. Kostelnik and A. Constant
ON Semiconductor

2:00 PM 9.2 Demonstration of GaN-on-silicon material system operating up to 3 kilovolts with reduced trapping effects
R. Kabouche¹, I. Abid¹, M. Zegaou¹, K. Cheng², and F. Medjdoub¹
¹IEMN-CNRS, ²Enkris Semiconductor

2:20 PM 9.3 Process Development Enabling Lateral GaN JFET Devices for Robust Power Switching on 200 mm Engineered Substrates
Travis J. Anderson¹, James C. Gallagher², Geoffrey M. Foster², Andrew D. Koehler¹, Marko J. Tadjer¹, Ozgur Aktas³, Vladimir Odnoblyudov¹, Cem Basceri³, Karl D. Hobart¹
¹U.S. Naval Research Laboratory, ²AAE Postdoctoral Fellow Residing at NRL, ³Qromis, Inc.

2:40 PM Student Presentation
9.4 Improved Dynamic ON-resistance of a Normally Off p-GaN Gate High-Electron-Mobility Transistor Using a Nongated-Region Oxidation Technique
Chia-Hao Liu¹, Hsuan-Ling Kao¹, Hsien-Chin Chiu¹, Yi-Sheng Chang¹, Hao-Yu Wang¹, Chao-Wei Chiu¹, Hsiang-Chun Wang¹, Chong Rong Haung¹, Xin-ke Liu²
¹Chang Gung University, ²Shenzhen University

3:00 PM Student Presentation
9.5 Low Interface Noise of p-GaN Gate Normally-off HEMT with Microwave Ohmic Annealing Process
Yi-Sheng Chang¹, Chia-Hao Liu¹, Chi-Chuan Chiu¹, Hsiang-Chun Wang¹, Hsien-Chin Chiu¹, Rong Xuan² and Chih-Wei Hu²
¹Chang Gung University, ²Episil-Precision Inc.
Wednesday, May 1st

SESSION 10: DEVICE PROCESSING I

Location: Nicollet A

Chairs: Thomas Roedle, Ampleon
        Walter Wohlmuth, WIN Semiconductors Corp.

1:30 PM  Invited Presentation
        10.1 Process Optimization for Improved Adhesion of Ti/Pt/Au to SiN and GaAs
                Ganesh Dindukurthi, Yashwanth Konakalla, Carl Miester, David Troy, Prasanta Modak
                TRUMPF Photonics Inc.

2:00 PM  Invited Presentation
        10.2 Damage-less Wet Etching for Normally-off AlGaN/GaN HEMTs using Photo-electrochemical Reactions
                Taketomo Sato, Keisuke Uemura, and Masachika Toguchi
                Research Center for Integrated Quantum Electronics, Hokkaido University

2:30 PM  10.3 Fabrication of Gallium Nitride Deep-Trench Structures by Photoelectrochemical Etching
                Fumimasa Horikiri¹, Hiroshi Ohta², Naomi Asai², Yoshinobu Nairita¹, Takehiro Yoshida¹,
                and Tomoyoshi Mishima²
                ¹SCIOCS, ²Hosei University

2:50 PM  10.4 Development of Advanced Lift Off Processes for 5G and VCSEL Applications
                Phillip Tyler¹, Jonathan Fijal¹, Kenji Nulman¹, Anil Vijayendran¹, David Rennie²,
                Jennifer Rieker², Alberto Dicese², John Zook², John Sagan², Phil Greene³, Shihu Deng³,
                Laura Mauer³
                ¹Veeco Instruments, ²EMD Performance Materials, ³Ferrotec Corporation

3:10 PM  10.5 Backside Processing of RF GaN-on-GaN HEMTs Considering Thermal Management
                Yamada, J. Kotani, T. Ohki, Y. Kawano, N. Nakamura and K. Watanabe
                Fujitsu Limited and Fujitsu Laboratories Ltd.

3:30 PM  BREAK
Wednesday, May 1st

SESSION 11: TEST & CHARACTERIZATION – CS DEVICES
Location: Niccollet B-C
Chairs: Anita Pacheco, Qorvo.
       Randy Lewis, Northrop Grumman Corp.

4:00 PM  Invited Presentation
11.1 Application-Specific, Comprehensive Technology and Product Qualification of GaN on Silicon Power Conversion Devices
Timothy McDonald
Infineon Americas Corporation

4:30 PM  Invited Presentation
11.2 Channel temperature determination for GaN HEMT lifetime testing – Impact of package and device layout
Filip Gucmann, James W. Pomeroy, Andrei Sarua, and Martin Kuball
Center for Device Thermography and Reliability (CDTR), University of Bristol

4:50 PM  Student Presentation
11.3 Extreme Temperature Operation of Ultra-Wide Bandgap AlGaN High Electron Mobility Transistors
P. H. Carey IV1, F. Ren1, A. G. Baca2, B. A. Klein2, A. A. Allerman2, A. M. Armstrong2, E. A. Douglas2, R. J. Kaplar2, S. J. Pearton1
1University of Florida
2Sandia National Laboratories

5:10 PM  Invited Presentation
11.4 JEDEC Guidelines and Standards for Compound Semiconductors
Donald A. Gajewski
Wolfspeed, A Cree Company
Wednesday, May 1st

SESSION 12: DEVICE PROCESSING II
Location: Nicollet A
Chair: Corey Nevers, Qorvo

4:00 PM 12.1 Elimination of Metal Fencing by Optimizing Evaporator Dome Alignment
Kezia Cheng
MACOM Technology Solutions

4:20 PM 12.2 The State-of-Art of GaN/Diamond HEMT Manufacturing Technology and Device Performance
Daniel Hou¹, Dan Benveniste¹, Won Sang Lee², Riccardo Soligo¹, and Kyung Won Lee³
¹Global Communication Semiconductors, LLC, ²RFHIC USA, ³RFHIC Corporation

4:40 PM 12.3 Optically-Defined 150-nm, 28-V GaN HEMT Process for Ka-Band
Kyle M. Bothe, Bruce Schmukler, Satyaki Ganguly, Terry Alcorn, Jennifer Gao, Chris Hardiman, Evan Jones, Dan Namishia, Fabian Radulescu, Jeffrey Baner, Jeremy Fisher, Don A. Gajewski, Scott T. Sheppard and Jim W. Milligan
Wolfspeed, A Cree Company

5:00 PM 12.4 3D Nanoprinting of Grayscale Features in GaN Devices to Reduce Peak Electric Fields
Andrew D. Koehler¹, Geoffrey M. Foster², James C. Gallagher², Joseph G. Tischler¹, Travis J. Anderson¹, Karl D. Hobart¹, Fritz J. Kub¹
¹U.S. Naval Research Laboratory, ²ASEE Postdoctoral Fellow Residing at NRL

5:20 PM 12.5 Activation of Ion Implanted Si in Semi-Insulating C-Doped GaN by High Pressure Annealing for Photoconductive Semiconductor Switch (PCSS) Applications
James C. Gallagher¹, Travis J. Anderson², Andrew D. Koehler², Geoffroy M. Foster¹, Alan G. Jacobs¹, Boris N. Feigelson³, Michael M. Mastro², Jennifer K. Hite², Karl D. Hobart²
¹ASEE Postdoctoral Fellow Residing at NRL, ²U.S. Naval Research Laboratory

6:00 PM RUMP SESSIONS – TOPICS TBD

8:00 PM SEMI STANDARDS MEETING
Thursday, May 2nd

SESSION 13: OPTOELECTRONICS PLENARY

Location: Nicollet B-C
Chairs: Stephen Myers, Lumentum
       Travis Abshere, nLight

8:00 AM Invited Presentation
13.1 VCSELs at a Glance
Dr. Vincent D. Mattera, Jr
II-VI

9:00 AM Invited Presentation
13.2 Volume Manufacturing of Highly Integrated System-On-Chip (SOC) InP-Based Photonic Integrated Circuits
Fred A. Kish, Steve Maranowski, Peter Debackere, Adam James, Andrew Dentai, Paul Liu, Payam Abolghasem, Nikhil Modi, Bala Vaddepay, Peter Evans, Vikrant Lal, Gloria E. Hoefler, Jianping Zhang, S. Stockman, and Mehrdad Ziari
Infinera Corporation

9:30 AM Invited Presentation
13.3 MicroLED Displays: Hype and Reality, Hopes and Challenges
Eric Virey, Zine Bouhamri, Pars Mukish
Yole Développement

10:00 AM BREAK
Thursday, May 2nd

SESSION 14: VCSEL

Location: Nicollet B-C

Chairs: Heribert Zull, OSRAM Opto Semiconductors GmbH
        Chris Stender, MicroLink Devices, Inc.

10:30 AM  14.1 3D Sensing/Imaging – The Next Killer Application for VCSELs? Yes If…
Pierrick Boulay, Pars Mukish
Yole Développement

10:50 AM  Invited Presentation
14.2 Future Present Foundry Model for III-V Manufacturing
Al Yuen
Lumentum

11:20 AM  Invited Presentation
14.3 Volume Manufacture of 150 mm VCSEL Epi-wafers
Ben Stevens, Adam Jandl, Aidan Daly, Andrew Clark, Hugues Marchand, Andrew Joel and Rodney Pelzel
IQE PLC

11:50 AM  Invited Presentation
14.4 Crystal Growth and Wafer Processing of 6” GaAs Substrates for Lasers
Tomonori Morishita
Sumiden Semiconductor Materials Co., Ltd.
Thursday, May 2nd

SESSION 15: TEST & CHARACTERIZATION OF WIDE BANDGAP HETEROSTRUCTURES

Location: Nicollet A
Chairs: David Via, Air Force Research Laboratory
       David Meyer, Naval Research Laboratory

10:30 AM  Student Presentation
15.1 Misinterpretation of Drain Transient Spectroscopy in GaN HEMTs:
Explanation using a floating buffer model
Manikant Singh¹, M. J. Uren¹, S. Karboyan¹,
H. Chandrasekar¹, T. Martin², and M. Kuball¹
¹CDTR, University of Bristol
²IQE Europe

10:50 AM 15.2 The Impact of Buffer Dopants on Stability of AlGaN/GaN HEMTs:
Characterization and Mechanism Investigation
Shenghou Liu, Guanyao Lin, Guan Zou,
Xianqing Cai, Boting Liu, Yutao Fang,
Yifeng Lu, Chuansu Lin, Zihan Guo, Nien-Tze Yeh, Kelly Chang, Sunny Sun, Frank Xu
Xiamen Sanan Integrated Circuit Corp., Ltd.

11:10 AM  Student Presentation
15.3 Interfacial mechanical stability and thermal resistance of GaN-on-diamond
Cainan Long, Roland B. Simon, Martin
Kuball and Dong Liu
CDTR, University of Bristol

11:30 AM  Student Presentation
15.4 Electrical and Thermal Characterisation of
β-(Al,Ga)(x-y)O3/Ga2O3 HEMTs
Taylor Moule¹, Manikant Singh¹, Serge
Karboyan¹, Elisha Mercado¹, Stefano
Dalcanale¹, Michael J Uren¹, Yuewei Zhang²,
Zhanbo Xia², Siddharth Rajan², Martin
Kuball¹
¹CDTR, University of Bristol
²The Ohio State University

11:50 AM 15.5 New Generation of Corona-charge Noncontact C-V (CnCV) Metrology for Characterization of Wide Bandgap Interfaces and Deep Interface Traps
M. Wilson, A. Savtchouk, C. Almeida, B. Schrayer, J. D’Amico and J. Lagowski
Semilab SDJ

12:20 PM  CS MANTECH LUNCHEON
**Thursday, May 2\textsuperscript{nd}**

**SESSION 16: PROCESS AND YIELD**

Location: *Nicollet B-C*

Chairs: Guoliang Zhou, *Skyworks Solutions*
        Kevin Stevens, *IQE*

1:30 PM  **16.1 Yield Improvements in a High-Mix Fabrication Environment**
        Rathnait D. Long\textsuperscript{1}, Sarah R. El-Helw\textsuperscript{1,2}, Ian Dalton\textsuperscript{1}, Maik Katko\textsuperscript{1}, Kezia Cheng\textsuperscript{1}, Marco Bonilla\textsuperscript{1}, William Allen\textsuperscript{1} & Craig Pastrone\textsuperscript{1}

\textsuperscript{1}MACOM Technology Solutions
\textsuperscript{2}Virginia Polytechnic Institute & State University

1:50 PM  **Student Presentation**

**16.2 Effects of Electrochemical Etching on InP HEMT Fabrication**

T. Saranovac, D. C. Ruiz, D. Han, A. Hambitner, A. M. Arabhavi, O. Ostinelli, and C. R. Bolognesi

*Millimeter-Wave Electronics Group (MWE) ETH-Zürich*

2:10 PM  **16.3 Lift-off Challenges in using CAMP Negative Photoresist Patterning in III-V IC Fabrication**

Daniel Berkoh and Shiban Tiku

*Skyworks Solutions*

2:30 PM  **16.4 Gross Die Per Wafer and Yield Optimization for GaAs ICs with Sub-Micron Features**

Robbie Best and Shiban Tiku

*Skyworks Solutions*

2:50 PM  **16.5 Development of stepper solutions for new IoT device challenges**

Bunsuke Takeshita\textsuperscript{1}, Douglas Shelton\textsuperscript{2}, Neel Chopra\textsuperscript{2}, Hiroyuki Miyazaki\textsuperscript{1}, and Ken-Ichiro Mori\textsuperscript{1}

\textsuperscript{1}Canon Inc., \textsuperscript{2}Canon U.S.A.

3:10 PM  **16.6 Applications of Natural Exponential Functions in Semiconductor Processes**

Xiaokang Huang, Linlin Chen, Arif Choudhury, Duofeng Yue, Qidu Jiang, Mengdi Mueller, John Griffin, Van Tran, Amit Kelkar

*Qorvo*
Thursday, May 2nd

SESSION 17: MATERIALS AND GROWTH
FUNDAMENTALS

Location: Nicollet A
Chairs: Rüdiger Schreiner, Consultant
       Wei Zhang, AXT

1:30 PM  Invited Presentation
17.1 P-type semiconductors in gallium oxide electronics
Kentaro Kanek¹, Shu Takemoto¹, Shin-ichi Kan¹, Takashi Shinohe², Shizuo Fujita¹
¹Kyoto University, ²FLOSFIA Inc.

2:00 PM  17.2 Development of Large Diameter Semi-Insulating Gallium Oxide (Ga2O3) Substrates
J.D. Blevins¹, K. Stevens², G. Foundos², A. Lindsey², L. Sande²
¹Air Force Research Laboratory (AFRL), ²Northrop-Grumman SYN OPTICS

2:20 PM  Invited Presentation
17.3 Machine Learning for SiC top-seeded solution growth – Prediction, Optimization and Visualization
Toru Ujihara¹, Yosuke Tsunooka¹, Goki Hatasa¹, Can Zhu¹, Kentaro Kutsukake¹, Taka Narumi¹, Shunta Harada¹, Miho Tagawa¹
¹Nagoya University, ²National Institute of Advanced Industrial Science and Technology
³Center for Advanced Intelligence Project, RIKEN

2:50 PM  Student Presentation
17.4 Analysis of High Mg-Incorporation into GaN via PAMBE Modulation Doping and Molecular Dynamics Simulations
Fawad Hassan Ismail, Matthew Landi, Frank Putnam Kelly, Kyekyoon (Kevin) Kim
University of Illinois at Urbana-Champaign

3:10 PM  17.5 Understanding GaN Homoepitaxial Growth and Substrate-Dependent Effects for Vertical Power Devices
Jennifer K. Hite¹, Travis J. Anderson¹, James C. Gallagher², Michael A. Mastro¹, Karl D. Hobart¹, Francis J. Kub¹, and Charles R. Eddy, Jr.
¹U.S. Naval Research Laboratory
²ASEE Postdoctoral Fellow Residing at NRL
Thursday, May 2nd

SESSION 18: POSTER

Chairs: Barry Wu, Keysight Technologies
       Shyh-Chiang Shen, Georgia Tech University
       Shiban Tiku, Skyworks Solutions
       Andrew Green, Air Force Research Laboratory

3:40 PM - 4:30 PM

18.1 RF GaN Market and Technology Trends
Ezgi Dogmus, Antoine Bonnabel and Hong Lin
Yole Développement

18.2 Addressing Cycle Time to Accelerate Yield Improvement and Improve Output
Michael Mandracchia
The MAX Group

18.3 Templated Liquid Phase Growth Combined with MOCVD for Growth of Crystalline III-V’s Directly on Oxide and Nitride Surfaces
Debarghya Sarkar, Mitchell Dreiske, P. Daniel Dapkus, Rehan Kapadia
University of South California

Student Presentation

18.4 GaN High-Performance Low-Leakage p-Iset MPS Diodes Enabled by PAMBE-Based Selective Area Growth
Palash Sarker, Frank Putnam Kelly, Riley Elis Vesto, Fawad Hassan Ismail, Kyekyoon (Kevin) Kim
University of Illinois at Urbana-Champaign

18.5 β-Ga2O3 and related alloys grown by MOCVD on a Multi-wafer production system
Nazar Orishchin, Fikadu Alema and Andrei Osinsky
Agnitron Technology, Inc.

18.6 WITHDRAWN

18.7 200 V – 20 A AlGaN/GaN MIS-HEMTs on Silicon Substrate with 60 mm Gate Width
Chia-Jui Yu¹, Tz-Chau Lin¹, Chien-Ju Chen¹, Jyun-Hao Liao¹, Meng-Chyi Wu¹, Wen-Ching Hsu², Chih-Yuan Chuang², and Jia-Zhe Liu²
¹National Tsing Hua University,
²Global Wafers Co., Ltd.
Thursday, May 2nd

18.8 A High Uniformity, High Yield 0.15 µm pHEMT Technology Manufactured by KrF 248 nm Stepper
Chao-Min Chang¹, Pei-Chin Chiu¹, Jeng-Han Tsai², Hui-Hsin Sun², Yun-Yue Hsieh², Zhi-Jie Zeng¹, Kun-Lin Lu¹, Chih-Peng Lin¹, Bo-Chin Wang¹, Sheng-Chun Wang¹, Chin-Fu Lin¹
¹Wavetek Microelectronic Corp.
²National Taiwan Normal University

Student Presentation
18.9 High Thermally Stable AlGaN/GaN High Electron Mobility Transistors (HEMTs) on Bulk Semi-Insulating GaN Substrates
Hao-Yu Wang¹, Hsien-Chin Chiu¹, Chong-Rong Huang¹, Hao-Chung Kuo², Sun-Wen Huang Chen², Xinke Liu¹
¹Chang Gung University
²National Chiao Tung University

Student Presentation
18.10 Reconfigurable 43 Gb/s Optical Link Test Based Upon On-Wafer Probes of GaAs Photodetectors and VCSELs up to 85 °C
Yu-Ting Peng, Junyi Qiu, Dufei Wu, Milton Feng
University of Illinois at Urbana-Champaign

Student Presentation
18.11 Development of GaN Vertical High-Power Devices Enabled by Plasma-Assisted Molecular Beam Epitaxy
Frank Putnam Kelly, Riley Elis Vesto, Palash Sarker, Fawad Hassan Ismail, Kyekyoon (Kevin) Kim
University of Illinois at Urbana-Champaign

Student Presentation
18.12 Comparative investigation of lattice-matched ternary and quaternary barriers for GaN-based HEMTs
S.Riedmüller¹,², J. Grünenpütt¹, M. Madel¹, and H. Blanck¹
¹United Monolithic Semiconductors GmbH
²University of Ulm
Thursday, May 2nd

Student Presentation

18.13 A Novel AlGaN/GaN MIS-HEMT with Enhanced Breakdown Voltage and Reduced Interface Trap Density
Chao Yang, Xiaorong Luo, T. Sun, A. Zhang, D. Ouyang, S. Deng, J. Wei, and Bo Zhang
University of Electronic Science and Technology of China

18.14 Buffer development for GaN power electronic applications using extrinsic carbon doping for a super-lattice structure
D. Fahle, M. Marx, H. Behmenburg, M. Kortemeyer, M. Heuken
AIXTRON SE

18.15 Dynamic Hydride Vapor Phase Epitaxy (D-HVPE) as a route to inexpensive, high-performance III-V materials and devices
John Simon, Kevin L. Schulte, Wondwosen Metaferia, Alessandro Cavalli, and Aaron J. Ptak
National Renewable Energy Laboratory

18.16 Innovative relaxed InGaN engineered substrates for red-green-blue µLEDs applications
Eric Guiot¹, David Sotta¹, Olivier Ledoux¹, Amélie Dussaigne², Sébastien Chenot¹, Benjamin Damilano³
¹SOITEC S.A., ²Univ. Grenoble Alpes
³Université Côte d’Azur, CNRS

4:30 PM    CONFERENCE CLOSING
Chairs: Eric Stewart, Northrop Grumman
        Greg Mills, ASAP/AXRTECH

Make sure to stay for the fun at the conference closing this year! Local comedian John DeBoer will be giving a short stand-up routine about Minnesota, cold weather, and engineers. Take a moment to enjoy a few laughs at the end of the week.
2018 BEST PAPERS AWARDS

On Tuesday morning, CS MANTECH will formally recognize the authors of the best paper and best student paper from the 2018 conference. Both awards are based on conference attendee on-line feedback. The Best Paper Award is named in honor of Dr. He Bong Kim, the founder of the International Conference on Compound Semiconductor Manufacturing Technology.

2018 He Bong Kim Best Paper:

Looking for reliability and high performance in RF and power conversion applications? Use GaN.
Umesh Mishra
*University of California Santa Barbara & Transphorm Inc.*

2018 He Bong Kim Best Paper Honorable Mention:

Automotive Industry Trends and Their Impact on the Future Vehicle
Kamal Khouri
*NXP Semiconductors*

2018 Best Student Paper:

Controlling Impurity-Induced Disordering Via Mask Strain for High-Performance Vertical-Cavity Surface-Emitting Lasers
Patrick Su, Thomas O’Brien, Jr., Fu-Chen Hsiao, and John. M. Dallesasse
*University of Illinois at Urbana-Champaign*

Congratulations to these award winning teams for their excellent presentation and technical contribution to our field!
TRANSPORTATION INFORMATION

Transportation Centers:
MSP International Airport (MSP): 12 miles from the hotel
Amtrak Station: 8 miles from the hotel

Public Transit Centers:
Light Rail station: 8 blocks from the hotel and takes you toward downtown, Mall of America, the airport, and St. Paul
Greyhound Bus Station: located 7 blocks from the hotel

Taxi:
Taxi transportation between the Hyatt Regency Minneapolis and the airport is approximately $45 - $50 for one passenger.

Ride-share:
Ride-share services from Uber & Lyft between the Hyatt Regency Minneapolis and the airport are approximately $23 - $42 for one passenger

Local Transit:
Single ride is $2.50. Day pass is $5. From the airport, take the blue line towards Target Field to Nicollet Mall stop. Then walk 8 blocks south on Nicollet Mall to the Hyatt Regency.

Airport SuperShuttle:
Transfer from the airport to the hotel is $14.40 per person with discount code BN5F2. Reservations are recommended from the airport to the hotel, and advance pickup arrangements must be secured to travel from the hotel to the airport. https://group.supershuttle.com/group-page/2019-cs-mantech-conference/

PARKING:
The Loring Parking Ramp is privately owned and is managed by Allied Parking Inc.
Overnight Self-Parking: $24
Overnight Valet parking: $39.00
Get the CS MANTECH App!

Search “Attendify” or scan the QR code below to take you directly to the app.

![QR Code](image)

Once the Attendify app is downloaded, search for “CS MANTECH” and join the app.

For non-smart phone users, a web-based version of the app is available at TBD

Go to www.csmantech.org and click on “2019 Online Digest”.