International Conference on Compound Semiconductor Manufacturing Technology

May 22\textsuperscript{nd} – 25\textsuperscript{th}, 2017
www.csmantech.org

Hyatt Regency Indian Wells Resort & Spa
Indian Wells, California, USA
Get the CS MANTECH App!

CS MANTECH 2017 will again feature a Mobile App and an Online Digital Technical Digest

More details will be published as information becomes available.

Hyatt Regency Indian Wells images courtesy of the Hyatt Regency Indian Wells Resort & Spa
CONFERENCE AT A GLANCE

SUNDAY, May 21

6:00 PM – 8:00 PM  REGISTRATION
REG Counters 1, 2, & 3

7:00 PM – 9:00 PM  JEDEC JC-14.7 MEETING
Villa Olivo & Patio

MONDAY, May 22

7:30 AM – 7:00 PM  REGISTRATION
REG Counters 1, 2, & 3

7:30 AM – 9:00 AM  CS MANTECH WORKSHOP
BREAKFAST
Indian Wells N, O

9:00 AM – 5:30 PM  CS MANTECH WORKSHOPS
Desert Vista A, B

7:00 AM – 8:30 AM  ROCS REGISTRATION
Desert Vista D, E

7:30 AM – 8:30 AM  ROCS BREAKFAST
Indian Wells P

8:30 AM – 5:00 PM  ROCS WORKSHOP
Desert Vista D, E

11:30 AM – 1:00 PM  LUNCHEON FOR CS MANTECH & ROCS WORKSHOPS
Indian Wells N, O, P

6:00 PM – 9:00 PM  EXHIBITS RECEPTION
Indian Wells I, J, K, L, M

TUESDAY, May 23

7:00 AM – 5:00 PM  REGISTRATION
REG Counters 1, 2, & 3

7:00 AM – 9:00 AM  BREAKFAST
Indian Wells I, J, K, L, M

8:00 AM – 8:30 AM  OPENING CEREMONIES
Indian Wells N, O, P

8:00 AM – 5:30 PM  EXHIBIT HOURS
Indian Wells I, J, K, L, M

8:30 AM – 10:30 AM  SESSION 1: PLENARY I
Indian Wells N, O, P

10:30 AM – 11:00 AM  BREAK
L, M Foyer
11:00 AM – 12:00 PM  **5G PANEL SESSION**  
   *Indian Wells N, O, P*

12:00 PM – 1:30 PM  **EXHIBITS LUNCH**  
   *Indian Wells I, J, K, L, M*

1:30 PM – 5:30 PM  **EXHIBITORS’ FORUM BREAKOUTS**  
   *Desert Vista D & E*

1:30 PM – 2:30 PM  **SESSION 2: PLENARY II**  
   *Indian Wells N, O, P*

2:30 PM – 3:00 PM  **BREAK**  
   *L, M Foyer*

3:00 PM – 4:00 PM  **SESSION 3: PLENARY III**  
   *Indian Wells N, O, P*

4:30 PM – 5:30 PM  **STUDENT FORUM**  
   *Desert Vista A*

7:00 PM – 10:30 PM  **INTERNATIONAL RECEPTION**

**WEDNESDAY, May 24th**

7:30 AM – 5:00 PM  **REGISTRATION**  
   *REG Counters 1, 2, & 3*

7:00 AM – 9:00 AM  **BREAKFAST**  
   *Indian Wells I, J, K, L, M*

8:00 AM – 9:40 AM  **SESSION 4: POWER DEVICES I**  
   *Indian Wells N, O*

8:00 AM – 9:40 AM  **SESSION 5: RF DEVICES**  
   *Desert Vista A, B*

8:00 AM – 11:00 AM  **EXHIBIT HOURS**  
   *Indian Wells I, J, K, L, M*

8:00 AM – 11:00 AM  **EXHIBITORS’ FORUM BREAKOUTS**  
   *Desert Vista D & E*

9:40 AM – 10:15 AM  **BREAK**  
   *L, M Foyer*

10:15 AM – 11:45 AM  **SESSION 6: POWER DEVICES II**  
   *Indian Wells N, O*

10:15 AM – 11:45 AM  **SESSION 7: MANUFACTURING**  
   *Desert Vista A, B*
11:45 AM – 1:15 PM  OPEN
Lunch at your own leisure or
time to explore Indian Wells

1:15 PM – 2:35 PM  SESSION 8: GaN EPITAXY
Indian Wells N, O

1:15 PM – 2:35 PM  SESSION 9: RELIABILITY
Desert Vista A, B

2:35 PM – 3:05 PM  BREAK
L, M Foyer

3:05 PM – 4:25 PM  SESSION 10:
PROCESSING–RESIST &
MATERIALS
Indian Wells N, O

3:05 PM – 4:25 PM  SESSION 11:
CHARACTERIZATION
Desert Vista A, B

4:25 PM – 4:40 PM  BREAK
L, M Foyer

4:40 PM – 6:00 PM  SESSION 12: PROCESS-
METALLIZATION
Indian Wells N, O

4:40 PM – 6:00 PM  SESSION 13: PROCESS-
DRY ETCH
Desert Vista A, B

7:00 PM – 9:00 PM  SEMI STANDARDS
MEETING
Villa Olivo & Patio

THURSDAY, May 25th

7:30 AM – 9:30 AM  REGISTRATION
REG Counters 1, 2, & 3

7:30 AM – 9:00 AM  BREAKFAST
Indian Wells L

8:15 AM – 9:45 AM  SESSION 14: EMERGING
TECHNOLOGIES
Indian Wells N, O

8:15 AM – 9:45 AM  SESSION 15:
HETEROGENEOUS
INTEGRATION
Desert Vista A, B

9:45 AM –10:20 AM  BREAK
L, M Foyer
<table>
<thead>
<tr>
<th>Time</th>
<th>Session Title</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>10:20 AM – 12:00 PM</td>
<td>SESSION 16: GaN MATERIALS</td>
<td>Indian Wells N, O</td>
</tr>
<tr>
<td>10:20 AM – 12:00 PM</td>
<td>SESSION 17: PROCESS CONTROL &amp; YIELD</td>
<td>Desert Vista A, B</td>
</tr>
<tr>
<td>12:00 PM – 1:30 PM</td>
<td>CS MANTECH LUNCH</td>
<td>Indian Wells L</td>
</tr>
<tr>
<td>1:30 PM – 2:40 PM</td>
<td>SESSION 18: DIELECTRICS FOR POWER DEVICES</td>
<td>Indian Wells N, O</td>
</tr>
<tr>
<td>1:30 PM – 2:40 PM</td>
<td>SESSION 19: OPTICAL DEVICES</td>
<td>Desert Vista A, B</td>
</tr>
<tr>
<td>2:50 PM – 4:00 PM</td>
<td>POSTER SESSION</td>
<td>Indian Wells M</td>
</tr>
<tr>
<td>2:50 PM – 4:00 PM</td>
<td>CLOSING RECEPTION</td>
<td>Indian Wells M</td>
</tr>
</tbody>
</table>
2017 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 2017 CS MANTECH Conference Committee gratefully acknowledges the support from our sponsors.

(Sponsor list confirmed at press)

**Platinum Sponsors:**
- Skyworks, Inc.
- Plasma-Therm, LLC
- Virginia Diodes, Inc.
  - Wolfspeed
- Itochu Plastics, Inc.
  - SCIOCS

**Gold Sponsors:**
- n&k Technology, Inc.
- Brewer Science, Inc.
  - The MAX Group
- SPTS Technologies
- WIN Semiconductors Corporation
  - Freiberger
- Accel-RF Corporation
  - MACOM
- Sumika Materials
- SawStreet
- Lam Research

**Silver Sponsors:**
- Qorvo
- CMK

**Media Sponsors:**
- Semiconductor Today
- CS Magazine
2016 CONFERENCE SPONSORS
We would again like to thank our 2016 sponsors!

Platinum Sponsors:
Northrop Grumman Corporation
Plasma-Therm, LLC
Virginia Diodes, Inc.
Skyworks, Inc.
Cree, Inc.
Qorvo

Gold Sponsors:
Brewer Science, Inc.
EMD Performance Materials Corp.
Materion
SPTS Technologies
The MAX Group
Sumitomo Electric
WIN Semiconductors Corporation
Itochu Plastics, Inc.
Freiberger
Accel-RF Corporation
SCIIOCS

Silver Sponsors:
MACOM
OEM Group, Inc.

Media Sponsors:
Semiconductor Today
CS COMPOUND SEMICONDUCTOR
Microwave Journal
2017 CONFERENCE HIGHLIGHTS

On behalf of the Technical Program Committee for the 2017 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. Here are the highlights for the program:

Monday, May 22nd:
- The program begins this year with our series of tutorial workshops. This year’s workshop theme is “The Compound Semiconductor Engineer’s Toolbox.” 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.

Tuesday, May 23rd:
- The CS MANTECH Conference formally begins in the morning with opening ceremonies that include the 2016 Best Paper awards, sponsorship recognition, and a conference overview along with a review of the conference mobile app.
- Following the opening ceremonies, we have our first plenary session, which will focus on 5G Technologies. The plenary will feature four invited industry speakers identifying directions, opportunities and challenges for the 5G market and devices. After the talks, we will have a 5G market overview from Strategies Unlimited followed by a panel discussion with the four speakers. It should be a highly informative session and panel discussion looking at a key market for compound semiconductors.
- After lunch in the Exhibits Hall, we will reconvene for two additional plenary sessions featuring invited talks on Power Electronics and Heterogeneous Integration.
- Tuesday afternoon will also include the Exhibitor’s Forum. The Exhibitors’ Forum provides an
opportunity for exhibitors to present marketing/technical presentations to conference attendees. Tuesday afternoon’s technical sessions 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). 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 Palm Springs Air Museum. [http://palmspringsairmuseum.org/](http://palmspringsairmuseum.org/)

Wednesday, May 24th:
- Wednesday morning begins with breakfast in the Exhibits Hall where attendees can follow up on questions from the Exhibitors’ Forum or meet with one or two new vendors before the technical sessions begin at 8:00 am.
- There is a full program of parallel sessions throughout the day. Parallel sessions have been structured so that attendees can move between talks and sessions, with minimal overlap between the parallel sessions.
- Lunch will be at your own leisure or time to explore Indian Wells
- Parallel sessions continue in the afternoon starting at 1:15 pm and conclude at 6:00 pm.
- At 7:00 pm the SEMI Standard Meeting will be held.

Thursday, May 25th:
- Thursday morning continues with parallel sessions starting at 8:15 am.
- 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 this year’s conference contest, which is a scavenger hunt, as well as for best poster and conference feedback. Conference feedback will be submitted using our Mobile Application. Come see the posters, join the hunt, and enjoy our conference Closing Reception.

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

Drew Hanser
Veeco Instruments, Inc
Technical Program Chair
2017 CS MANTECH
2017 ROCS WORKSHOP

Reliability of Compound Semiconductors

Monday, May 22nd, 2017
Hyatt Regency Indian Wells Resort & Spa
Room: Desert Vista D, E
8:00 a.m. – 5:00 p.m.

The 32nd annual ROCS Workshop will be held in conjunction with the CS MANTECH Conference on Monday May 22nd, 2017, at the Hyatt Regency Indian Wells Resort & Spa in Indian Wells, California, 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. Potential authors are invited to submit an electronic copy of a one- or two-page comprehensive summary, suitable for a 15-minute presentation, to rocs@jedec.org. Late papers of significant interest may be considered up to the date of the Workshop. The Advanced Program will be published approximately one month prior to the meeting at http://www.jedec.org/home/gaas/.

Advance registration for the workshop is $100 for students, $200 for JEDEC members, and $225 for non-members; on-site registration is $275 for everyone. Registration includes a full day of ROCS presentations, two breaks, a luncheon and a copy of the Proceedings. Late registration will be available starting at 7:30 a.m. on the morning of the Workshop. For further information or to register on-line (through May 8th, 2017), visit our web site at http://www.jedec.org/home/gaas/ or contact: Martin Kuball, Workshop Chairman, University of Bristol, Martin.Kuball@bristol.ac.uk
INDUSTRY EXHIBITS

2017 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, including vendors of substrates; process gas and specialty material suppliers; fabrication, inspection, and test equipment providers; technical and manufacturing consulting services; and industrial publication venues.

To facilitate interactions between exhibitors and attendees, an Exhibits Reception will be held on Monday evening, May 22nd, in the exhibition hall (Indian Wells Ballroom I, J, K, L, M). The exhibits will also be open all day Tuesday, May 23rd, through Wednesday morning, May 24th, 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 Tuesday afternoon and Wednesday morning as break-out sessions in parallel with the main conference technical talks. These events provide participating exhibitors an opportunity to more fully showcase their products and services. Due to limited availability of time slots for the Exhibitor Forum, participation will be determined on basis of registration date (i.e., those registering early will have highest priority).

Registration for the exhibits and the exhibitor forum is available through the CS MANTECH website at www.csmantech.org/exhibitors. For questions or further information, please contact Patrick Fay, 2017 Exhibits Chair, at exhibitor@csmantech.org.
2017 EXHIBITORS

Accel-RF Corporation
AIXTRON Inc.
ASAP
AXT, INC.
BISTel America
Brewer Science, Inc.
C&D Semiconductor
California Coating Systems
Canon USA
Capitol Scientific
ClassOne Technology
Compound Semiconductor Magazine
CS CLEAN SOLUTIONS, Inc
Denton Vacuum
DISCO Hi-Tec America, Inc.
DOWA International Corporation
EAG Laboratories
ePAK International, Inc
EpiGaN
Evatec AG
Ferrotec USA Corp.
FRT of America
HEATEFLEX CORPORATION
II-VI Advanced Materials
II-VI EpiWorks, Inc.
INNOViON Corporation
Insaco, Inc
Inspectrology LLC
Intelligent Epitaxy Technology Inc.
IQE plc
JST Manufacturing Inc.
Kinetics
KITEC GmbH
Lehighton Electronics, Inc.
Logitech Ltd
Materion
MATHESON
MEI Wet Process Systems
MicroChem Corp.
Microtronic Inc.
Nanotronics
NTT Advanced Technology Corporation
NuFlare Technology, Inc.
Oxford Instruments
Picosun
Plasma-Therm, LLC

List of 2017 Exhibitors continued on next page
List of 2017 Exhibitors - continued

Pozzetta, Inc
Proton OnSite
Revasum
SAMCO Inc.
SawStreet LLC
Semiconductor Today
Semilab USA LLC
SGL Group - The Carbon Company
Shin-Etsu MicroSi
Siconnex customized solutions GmbH
SPTS Technologies
StratEdge Corporation
SUMIKA
Teikoku Taping System Inc.
Toho Technology
ULVAC
Vacuum Engineering & Materials
Veeco
Virginia Diodes Inc.
Visual Photonics Epitaxy Co., Ltd
Wafer World Inc.
Wolfspeed
Special Thanks to our 2016 EXHIBITORS!

Accel-RF Corporation
AIXTRON, Inc.
ASAP Co., Ltd.
AXT, Inc.
Benchmark Technologies
Brewer Science, Inc.
C&D Semiconductor
California Coating Systems
Canon USA
China Crystal Technologies
ClassOne Technology
Cree, Inc.
CS CLEAN SYSTEMS
CS COMPOUND SEMICONDUCTOR
CyberOptics Corporation
DISCO Hi-Tec America, Inc.
DOWA
EMD Performance Materials Corp.
ePAK International, Inc.
   EpiGaN
Evans Analytical Group
Evatec AG
Ferrotec USA Corp.
FRT of America
ICAMR
II-VI Advanced Materials
II-VI EpiWorks
INNOViON Corporation
Insaco, Inc.
Inspectrology
IntelliEpi
IQE
JST Manufacturing Inc.
   Kinetics
KITEC GmbH
KLA-Tencor
k-space Associates, Inc.
LayTec
Lehighton Electronics, Inc.
Levitronix Technologies LLC
Logitech Ltd.
   Mersen
MicroChem Corp.
   Microsanj
MicroSense, LLC
Microtronic, Inc.
List of 2016 Exhibitors continued on next page
List of 2016 Exhibitors - continued

Microtronic, Inc.
NuFlare Technology, Inc.
OEM Group, Inc.
Oxford Instruments
Plasma-Therm
Pozzetta
Picosun USA LLC
Plasma-Therm, LLC
Pozzetta
SAMCO Inc.
SawStreet LLC
Semiconductor Today
SGL Group, The Carbon Company
Shin-Etsu microSi
Siconnex
Silicon Materials Inc.
SPTS Technologies
Semiconductor Research Technology – STR Group
Strasbaugh
Sumika Electronic Materials, Inc.
The MAX Group
Trion Technology
ULVAC
Vacuum Engineering & Materials VEM
Veeco PSP
Virginia Diodes, Inc.
Visual Photonics Epitaxy Co., Ltd
Vital Materials
Wafer World Inc.
2016 BEST PAPERS AWARDS

On Tuesday morning, CS MANTECH will formally recognize the authors of the best paper and best student paper from the 2016 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.

2016 He Bong Kim Best Paper:

**Epitaxial Lift-off and Transfer of III-N Materials and Devices from SiC**
David J. Meyer¹, Brian P. Downey¹, Travis J. Anderson¹, D. Scott Katzer¹, Neeraj Nepal¹, Virginia D. Wheeler¹, David F. Storm¹, and Matthew T. Hardy²
¹Naval Research Laboratory, Electronics Science and Technology Division, ²NAS NRC Postdoctoral Fellow, residing at the Naval Research Laboratory

2016 He Bong Kim Best Paper Honorable Mention:

**Millimeter-wave GaN HEMTs with Cavity-gate Structure Using MSQ-based Inter-layer Dielectric**
Shiro Ozaki¹,², Kozo Makiyama¹,², Toshihiro Ohki¹,², Yoichi Kamada², Masaru Sato¹,², Yoshitaka Niida¹,², Naoya Okamoto¹,², and Kazukiyo Joshin¹,²
¹Fujitsu Limited, ²Fujitsu Laboratories Ltd.

2016 Best Student Paper:

**Simulation of Fabrication- and Operation -Induced Mechanical Stress in AlGaN/GaN Transistors**
Sameer Joglekar¹, Chuanxin Lian², Rajesh Baskaran², Yan Zhang², Tomás Palacios¹, and Allen Hanson²
¹Massachusetts Institute of Technology, ²MACOM Technology Solutions Inc.

2016 Best Student Paper Honorable Mention:

**Nonalloyed Refractory Metals for Self-Aligned InP HBT Emitter Contacts with InAs/InGaAs Emitter Cap**
Ardy Winoto, Junyi Qiu, and Milton Feng
Department of Electrical and Computer Engineering, University of Illinois

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

This year CS MANTECH is excited to have the International Reception at the Palm Springs Air Museum. The Museum preserves, exhibits, and flies aircraft from World War II, Korea, and the Vietnam Wars. Most of the aircraft are in flyable condition. There are numerous exhibits and of course, there will be food and beverages. Transportation leaves the hotel at 6:30 pm and will return periodically from the Museum. The last bus leaves at 10:30 pm. There is also ample parking for those who choose to drive. For additional information on the museum, please see the Palm Springs Air Museum website at http://palmspringsairmuseum.org/.

SEMI STANDARDS MEETING

The SEMI Standards meeting is scheduled for Wednesday May 24th, from 7:00 pm to 9:00 pm. 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 San Jose, 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 Brussels, Moscow, Tokyo, Seoul, Hsinchu, Beijing, Singapore, Austin, Boston 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 Paul Trio at 408-943-6900 or ptrio@semi.org.
**CS MANTECH CONFERENCE CONTEST**

This year, the 2017 CS MANTECH conference contest is a scavenger hunt. During the conference, you will be on the hunt for hidden treasure. CS MANTECH commemorative coins will be hidden throughout the conference areas of the hotel (sessions, exhibits, break areas, etc.) and your goal will be to gather as many coins as possible before the poster session and the conference closing. The winner will be the individual who collects the most coins and the prize will be presented at the closing ceremonies. Details for the conference contest will be available at registration and during the opening ceremonies.

**CS MANTECH MOBILE APP**

Get the CS MANTECH mobile app! This year CS MANTECH is again featuring a mobile app that will allow attendees to customize their conference schedules, easily find event times and locations, view papers, and connect with other attendees. The CS MANTECH mobile app will also be your opportunity to rate the papers for the conference best paper awards and provide feedback on the conference.

The CS MANTECH App is free. More information on the CS MANTECH App and where to download will be published as information becomes available.

**2017 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 2017 International Conference on Compound Semiconductor Manufacturing Technology will be available for download and viewing from our online site during the conference. Printed 2017 digests will be offered to attendees who request a copy at the time of conference registration and if registration is completed by the early registration deadline (April 20th). See the REGISTRATION INFORMATION section for more details.

*Note: Digital copies of the 2017 papers will not be distributed through USB portable memory sticks as done in previous years.*
2017 EXECUTIVE COMMITTEE

Chairman Emeritus
He Bong Kim, GaAstronics

Conference Chair
Celicia Della-Morrow, Qorvo

Technical Program Chair
Drew Hanser, Veeco Instruments, Inc.

Publication Chair
Jansen Uyeda,
Northrop Grumman Corporation

Local Arrangements Chair
Thorsten Saeger, Qorvo

Exhibits Chair
Patrick Fay, University of Notre Dame

Workshop Chair
David Meyer, Naval Research Laboratory

Publicity Chair
Michelle Bourke, Lam Research Corporation

Sponsorship Chair
Kelli Rivers, Vacuum Engineering & Materials

Local Arrangements Vice-Chair
Peter Erslend, MACOM Technology Solutions

International Liaisons
Europe: Martin Kuball, University of Bristol
Asia: Chang-Hwang Hua, WIN Semiconductors Corp

Registration Chair
Rudiger Schreiner, Consultant

Web Chair
Shawn Burnham, HRL Laboratories

University Liaison
Martin Kuball, University of Bristol

International Reception Chair
Alex Smith, Brewer Science, Inc.

Information Chair
Andy Souzis, II-VI, Inc.

Budget Chair
Sharon Woodruff, Northrop Grumman Corporation

Audio Visual Chair
Karen Moore, NXP Semiconductors

Communications Chair
Michelle Bourke, Lam Research

Feedback Chair
Shawn Burnham, HRL Laboratories

Committee Members
Yohei Otoki, SCIIOCS
Scott Davis, Sumitomo Electric
Marty Brophy, Broadcom, Ltd
2017 BOARD OF DIRECTORS

Board of Directors Chair
Paul Cooke, IQE

Secretary
Karen Renaldo,
Northrop Grumman Corporation

 Treasurer
Travis Abshere, nLight

Board Members
Mike Barsky, Northrop Grumman Corporation
Marty Brophy, Broadcom, Ltd.
Scott Davis, Sumitomo Electric
Celicia Della-Morrow, Qorvo
Peter Ersland, MACOM Technology Solutions
Mariam Sadaka, Soitec USA
Chris Santana, IQE
Scott Sheppard, Wolfspeed, A Cree Company
Glen “David” Via, Air Force Research Laboratory

TECHNICAL PROGRAM COMMITTEE

Jon Abrokwah, Broadcom, Ltd.
Travis Abshere, nLight
Kamal Alavi, Raytheon
Zaher Bardai, IMN.EPIPHANY, Technology Business Consulting
John Blevins, Air Force Research Laboratory
Karlheinz Bock, University of Dresden, TU Dresden
Michelle Bourke, Lam Research
Marty Brophy, Broadcom, Ltd.
Shawn Burnham, HRL Laboratories
Paul Cooke, IQE
Jim Crites, Skyworks Solutions
Scott Davis, Sumitomo Electric
Celicia Della-Morrow, Qorvo
Andreas Eisenbach, IQE
Peter Ersland, MACOM Technology Solutions
Patrick Fay, University of Notre Dame
Milton Feng, University of Illinois
Don Gajewski, Wolfspeed, A Cree Company
Shalini Gupta, Northrop Grumman Corporation
Drew Hanser, Veeco Instruments, Inc.
Allen Hanson, MACOM Technology Solutions
Queznell Hartmann, II-VI EpiWorks
Haldane Henry, Qorvo
Chang-Hwang Hua, WIN Semiconductors Corp.
Hiroyuki Ichikawa, Sumitomo Electric Industries, Ltd.
Hidetoshi Kawasaki, Sony Semiconductor Solutions
Nick Kolarich, II-VI EpiWorks
Russell Kremer, Freiberger Compound Materials
Judy Kronwasser
Martin Kuball, University of Bristol
Barbara Landini, Sumika Electronic Materials
Chun-Lim Lau, Booz Allen Hamilton
Randy Lewis, Northrop Grumman Corporation
Chuanxin Lian, MACOM Technology Solutions
Earl Lun, EJL Wireless Research
Steve Mahon, Feldman Engineering
David Meyer, Naval Research Laboratory
Greg Mills, ASAP/AXRTECH
Bobb Mohondro, S-cubed
Karen Moore, NXP
Corey Nevers, Qorvo
Ota Yogi, Panasonic Corporation
Yohei Otoki, SCIIOCS
Karen Renaldo, Northrop Grumman Corporation
Kelli Rivers, Vacuum Engineering & Materials Co.
Thomas Roedle, Ampleon
Mariam Sadaka, Soitec USA
Robert Sadler, Global Communication Semiconductors, LLC
Thorsten Saeger, Qorvo
Keith Salzmann, Qorvo
Gerhard Schoenthal, Virginia Diodes, Inc.
Rudiger Schreiner, Consultant
Shyh-Chiang Shen, Georgia Tech
Scott Sheppard, Wolfspeed, A Cree Company
Alex Smith, Brewer Science, Inc.
Andy Souzis, II-VI, Inc.
Joerg Splettstoesser, United Monolithic Semiconductor GmbH
Kevin Stevens, IQE
Hermann Stieglauer, United Monolithic Semiconductor GmbH
Mike Sun, Skyworks Solutions
Shiban Tiku, Skyworks Solutions
Naveen Tipirneni, Texas Instruments Inc
Matthew Tyhach, Raytheon
Jansen Uyeda, Northrop Grumman Corporation
Kevin Vargason, IntelliEPI
Glen “David” Via, Air Force Research Laboratory
David Wang, Global Communication Semiconductors, LLC
Russ Westerman, Plasma-Therm, LLC
Keith Wieber, Qorvo
Sharon Woodruff, Northrop Grumman Corporation
Barry Wu, Keysight Technologies
Wei Zhang, AXT
Guoliang Zhou, Skyworks Solutions
Heribert Zull, OSRAM Opto Semiconductors GmbH
TECHNICAL PROGRAM

Monday, May 22nd

CS MANTECH WORKSHOPS
“The Compound Semiconductor Engineer’s Toolbox”

Chair: David Meyer, Naval Research Laboratory

7:30 AM  REGISTRATION

9:00 AM  Tools for Device Physics
         Dr. Debdeep Jena, Cornell University

10:15 AM  Tool for Thin Film Strain Engineering
          Dr. Rajinder (Randy) Sandhu, Northrop Grumman Corporation

11:30 AM  WORKSHOP LUNCH
          (CS MANTECH & ROCS)

1:00 PM  Tools for Process Development
         Martin (Marty) Brophy, Broadcom, Ltd

2:15 PM  Tools for RF Characterization
         Dr. Patrick Fay, University of Notre Dame

4:15 PM  Tools for Statistical Analysis
         Dario Nappa, Qorvo

5:30 PM  WORKSHOP CLOSING

6:00 PM  EXHIBITS RECEPTION

ROCS WORKSHOPS

Chair: Martin Kuball, University of Bristol

7:00 AM - 8:30 AM  ROCS Registration

8:30 AM - 5:00 PM  ROCS Workshop Sessions

11:30 PM – 1:00 PM  WORKSHOP LUNCH
                     (CS MANTECH & ROCS)

6:00 PM  EXHIBITS RECEPTION
Tuesday, May 23rd

CONFERENCE OPENING

8:00 AM   Opening Ceremonies
Celicia Della-Morrow, Conference Chair
Qorvo

8:10 AM   2016 Conference Best Paper Awards
Celicia Della-Morrow, Conference Chair
Qorvo

8:20 AM   Technical Program Highlights
Drew Hanser, Technical Program Chair
Veeco Instruments, Inc.

SESSION 1:  PLENARY I - 5G Technologies
Chair: Drew Hanser, Veeco Instruments, Inc.

8:30 AM   Invited Presentation
1.1 Technology Initiatives for 5G Radio Front-End Modules
Stephen J. Kovacic
Skyworks Solutions, Inc.

9:00 AM   Invited Presentation
1.2 mmWave Semiconductors in 5G and A/D - A Unique View from Someplace in Between
Daniel Thomasson
Keysight Technologies, Inc.

9:30 AM   Invited Presentation
1.3 The 5G Effect on RF Filter Technologies
Steven Mahon
Feldman Engineering

10:00 AM  Invited Presentation
1.4 TBD
Debabani Chowdhury
Intel Corporation

10:30 AM  BREAK
Tuesday, May 23rd

PANEL SESSION: 5G Market Overview
Chair: Drew Hanser, Veeco Instruments, Inc.

11:00 AM  Invited Presentation
5G.1  Is 5G the Next RF Compound Semiconductor Industry Driver?
Eric Higham, Strategy Analytics

11:20 AM  5G Technology Panel Session
Moderator: Eric Higham, Strategy Analytics

Panel:
Stephen J. Kovacic, Skyworks Solutions, Inc.
Daniel Thomasson, Keysight Technologies, Inc.
Steven Mahon, Feldman Engineering
Debabani Chowdhury, Intel Corporation

12:00 PM  EXHIBITS LUNCH

SESSION 2: PLENARY II – Power Electronics
Chair: Michelle Bourke, Lam Research

1:30 PM  Invited Presentation
2.1  Current Progress in SiC Power MOSFETs and Materials
John Palmour
Wolfspeed

2:00 PM  Invited Presentation
2.2  Leveraging Power Electronics Acumen to Accelerate the Adoption Rate of Gallium Nitride
Steve Tom
Texas Instruments

2:30 PM  BREAK
Tuesday, May 23\textsuperscript{rd}

SESSION 3: PLENARY III – Heterogeneous Integration

Chair: Barry Wu, Keysight Technologies

3:00 PM Invited Presentation
3.1 InAs/GaAs Quantum Dot Lasers of Exact GaP/Si (001) and Other Templates
J. E. Bowers\textsuperscript{1}, A. Y. Liu\textsuperscript{1}, D. Jung\textsuperscript{1}, J. Norman\textsuperscript{1}, A. C. Gossard\textsuperscript{1}, Y. Wan\textsuperscript{2}, Q. Li\textsuperscript{2}, K. M. Lau\textsuperscript{2} and M.L. Lee\textsuperscript{3}
\textsuperscript{1}University of California – Santa Barbara,
\textsuperscript{2}Hong Kong University of Science and Technology, \textsuperscript{3}University of Illinois – Urbana-Champaign

3:30 PM Invited Presentation
3.2 A Si-Compatible Fabrication Process for Scaled Self-Aligned InGaAs FinFETs
A. Vardi, J. Lin, W. Lu, X. Zhao, J. A. del Alamo
Microsystems Technology Laboratories, Massachusetts Institute of Technology

4:30 PM STUDENT FORUM

7:00 PM INTERNATIONAL RECEPTION
Palm Springs Air Museum
(Transportation leaves the hotel at 6:30 pm)
Wednesday, May 24th

SESSION 4: POWER DEVICES I
Chair: Allen Hanson, MACOM Technology Solutions

8:00 AM 4.1 A Wafer-Level Uniformity Improvement by the Substrate Off Angle Control for the Vertical GaN-on-GaN Power Switching Devices
F. Horikiri¹, Y. Narita¹, T. Yoshida¹, T. Kitamura¹, Y. Abe¹, H. Ohta¹, T. Nakamura², T. Mishima²
¹Sciocs Company Ltd., ²Hosei University

8:20 AM 4.2 Study of Current Collapse in Single (AlGaN/GaN) and Double (AlGaN/GaN/AlGaN) Heterostructure Enhancement Mode HEMTs
C.-H. Lee¹, S.-Y. Ho¹, J.-X. Zhang², H.-K. Lin², J.-J. Huang¹
¹Graduate Institute of Photonics & Optoelectronics, National Taiwan University, ²Neoton Optoelectronics

8:40 AM 4.3 Optimized Design of 3-Dimensional Field Plate in AlGaN/GaN HEMTs for Collapse-Free Operation
A. Suzuki, J. T. Asubar, H. Tokuda, M. Kuzuhara
Graduate School of Engineering, University of Fukui

9:00 AM 4.4 Improved Uniformity on E-mode GaN-on-Si MIS-HEMTs Fabrication by High-Temperature Gate Recess Technique
J. Zhang¹, S. Huang², X. Kang³, X. Wang³, K. Wei³, Y. Shi¹, Q. Zhou¹, W. Chen¹, B. Zhang¹, X. Liu²
¹State Key Laboratory of Electronic Thin Films & Integrated Devices, University of Electronic Science & Technology of China, ²Department of Microwave Devices & Integrated Circuits, Institute of Microelectronics, Chinese Academy of Sciences

9:20 AM 4.5 Performance Improvement using Diluted KOH Passivation on Recessed-gate AlGaN/GaN Metal-oxide-semiconductor High-electron-mobility Transistors Grown on 8-inch Silicon(111) Substrates
Y.-H. Jiang¹, L.-C. Chang¹, K.-C. Hsu¹, I-C. Tseng², C.-H. Wu¹²
¹Graduate Institute of Electronic & Engineering, ²Graduate Institute of Photonics & Optoelectronics, National Taiwan University

9:40 AM BREAK
Wednesday, May 24th

SESSION 5: RF DEVICES
Chairs: Shyh-Chiang Shen, Georgia Tech
       Dane Henry, Qorvo

8:00 AM  Student Presentation
5.1 Pt Gate Sink-In Process Details Impact on InP HEMT DC and RF Performance
         T. Saranovac, O. Ostinelli, C.R. Bolognesi
         ETH-Zürich

8:20 AM  5.2 High Performance InGaAs MOSFETs with an InGaP Interface Control Layer
         and ALD-Al2O3 Gate Oxide for RF Switch Applications
         Q. Xia, K. Huang, H. Chang, S. Wang, B. Sun, H. Liu
         Key Laboratory of Microelectronics Devices & Integrated Technology, Institute of
         Microelectronics, Chinese Academy of Sciences

8:40 AM  5.3 None-Doped InGaP/GaAs Hetero-Junction p-Channel FET
         K. Miyakoshi, N. Nomura, T. Kameyama
         New Japan Radio Co., Ltd.

9:00 AM  5.4 InP Based Engineered Substrates for Photonics and RF Applications
         E. Guiot1, A. Drouin1, C. Charles-Alfred1, O. Ledoux2, C. Cadieux2
         1SOITEC S.A., 2University Grenoble Alpes

9:20 AM  5.5 First Demonstration of a GaN-SiC RF Technology Operating Above 100 V in S-Band
         G. Formicone, J. Custer, J. Burger
         Integra Technologies, Inc.

9:40 AM  BREAK
Wednesday, May 24th

SESSION 6: POWER DEVICES II
Chair: John Blevins, Air Force Research Laboratory

10:15 AM  Invited Presentation
6.1 GaN Vertical Power Devices for Electric Vehicles
T. Kachi
Institute of Materials and Systems for Sustainability, Nagoya University

10:45 AM  Student Presentation
6.2 High Performance Normally-Off Operation p-GaN Gate HEMT with Composited Barriers Structure Design
Y.-S. Chang¹, B.-H. Li¹, H.-C. Wang¹, H.-C. Chiu¹, R. Xuan², C.-W. Hu², J.-R. Tsai³
¹Department of Electronics Engineering, Chang Gung University, ²Technology Development Division, Episil-Precision Inc, ³Department of Photonics and Communication Engineering, Asia University

11:05 AM  Student Presentation
6.3 A Low Knee Voltage of 4H-SiC TSBS Employing Poly-Si/Ni dual Schottky Contacts
D.Y. Kim¹,², H. Park², W. Bahng², H.W. Kim², K.C. Park¹, H.-S. Lee¹,², O. Seok²
¹Department of Semiconductor Engineering, Gyeongsang National University, ²Power Semiconductor Research Center, Korea Electrotechnology Research Institute

11:25 AM  Student Presentation
6.4 Comparison of Floating and Grounded Substrate Termination on the Dynamic Performance of GaN-on-Si Power Transistors
Technology Development Center, Xiamen San’an Integrated Circuit Co., Ltd.

11:45 AM  OPEN
Lunch at your own leisure or time to explore Indian Wells
Wednesday, May 24th

SESSION 7: MANUFACTURING

Chairs: Doug Campbell, ePak
Barb Landini, Sumika Electronic Materials

10:15 AM  Invited Presentation
7.1 TBD
*The MAX Group*

10:45 AM  7.2 III-V Compound Semiconductor Manufacturing in China: from Optoelectronic to Microwave Applications
*Xiamen Sanan Integrated Circuit (Sanan-IC) Co., Ltd.*

11:05 AM  7.3 Stacked Capacitors and Adaptive Manufacturing
M.G. Meeder, P.J. Zampardi, B. Moser
*Qorvo*

11:25 AM  7.4 Evaporator Overall Equipment Effectiveness
M. LaFevre, H. Knoedler
*Skyworks Solutions, Inc.*

11:45 AM  OPEN
Lunch at your own leisure or time to explore Indian Wells
**Wednesday, May 24th**

**SESSION 8: GaN EPITAXY**

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

1:15 PM  **8.1 Real-Time Control of Layer Thickness and Thickness Uniformity for Single Wafer Reactor MOCVD Systems**
         S. Krishnan, M. Chansky, D. Kwon, E. Marcelo, M. Deshpande, R. A. Arif, A. Paranjpe
         *Veeco MOCVD Operations*

1:35 PM  **8.2 Single-wafer Multi-Reactor MOCVD Tool for GaN Based Devices**
         Y. Iyechika, H. Takahashi, S. Mitani
         *TFW Equipment Engineering Department, NuFlare Technology, Inc.*

1:55 PM  **8.3 Blue LED MOCVD Manufacturing Yield Optimization**
         A.R. Boyd, O. Feron, P. Lauffer, H. Behmenburg, M. Luenenbuerger, R. Leiers,
         A. Beckers, M. Heuken
         *AIXTRON SE*

2:15 PM  **8.4 Good Repeatability of AlGaN/GaN HEMT on 4” Si Substrate by 5x4” Multi-Wafer Production MOCVD System**
         P. Ji, Y. Feng, J. Cheng, J. Zhang, C. Song, X. Yang, B. Shen
         *State Key Laboratory of Artificial Microstructure and Mesoscopic Physics, School of Physics, Peking University*

2:35 PM  **BREAK**
Wednesday, May 24th

SESSION 9: RELIABILITY

Chairs: Don Gajewski, Wolfspeed, A Cree Company
       Shawn Burnham, HRL Laboratories

1:15 PM  9.1 Preliminary DC Evaluation of HRL’s T3 GaN Technology Reliability Characteristics
         HRL Laboratories, LLC.

1:35 PM  Student Presentation
         9.2 Investigation of the Impacts of Interfacial Layers on the Degradation of GaN-on-Si HEMTs under Electrical Step Stress Testing
         L. Yates¹, C.-F. Lo², T. Bai³, M.S. Goorsky³, W. Johnson², S. Graham¹
         ¹George W. Woodruff School of Mechanical Engineering, Georgia Institute of Technology, ²IQE, ³Department of Materials Science and Engineering, University of California, Los Angeles

1:55 PM  9.3 New Failure Mode in a High-Reliability GaN HEMT Technology
         B.M. Paine, N.T. Kubota
         Technology Qualification, Boeing Network and Space Systems

2:15 PM  Student Presentation
         9.4 Statistical Analysis of Lifetimes of MIM Capacitors with Monte Carlo Simulation
         M. Zhu¹, C. Lian², H.G. Xing¹,³,⁴ A. Hanson²
         ¹School of Electrical and Computer Engineering, Cornell University, ²MACOM Technology Solutions Inc., ³Department of Materials Science and Technology, Cornell University, ⁴Kavli Institute at Cornell for Nanoscale Science, Cornell University

2:35 PM  BREAK
**Wednesday, May 24th**

**SESSION 10: PROCESSING – RESIST & MATERIALS**

**Chairs:** Hermann Stieglauer, *United Monolithic Semiconductor GmbH*
Gerhard Schoenthal, *Virginia Diodes, Inc.*

**3:05 PM Student Presentation**

10.1 **Comparison of Charge Dissipation Layers and Dose Sensitivity of PMMA Electron Beam Lithography on Transparent Insulating Substrates such as GaN**

A. Hambitzer¹, A. Olziersky², T. Saranovac¹, C.R. Bolognesi¹

¹ETH Zürich, MWE Lab, ²IBM Research-Zürich

**3:25 PM**

10.2 **Effect of Different Developer Types on Resist Dimension and Side Wall Profile**

G. Sharma, R. Nutter

*HRL Laboratories, LLC*

**3:45 PM**

10.3 **Design Rule Study of Transfer Molding Process on Polymer Cavity Packages**

N. Honda¹, Y. Hakone¹, Y. Ono¹, M. Quillen², H. Lee³


**4:05 PM**

10.4 **Single Compound Target Sputtering of Al₁₋ₓScₓN Films for High Volume Manufacturing on 200mm Si Wafers**

B. Heinz, O. Rattunde

*Evatec AG*

**4:25 PM BREAK**
Wednesday, May 24th

SESSION 11: CHARACTERIZATION
Chair: Peter Erland, MACOM Technology Solutions

3:05 PM  Student Presentation
11.1 Monitoring the Transient Thermal Response of AlGaN/GaN HEMTs using Transient Thermoreflectance Imaging
G. Pavlidis, S. Graham
Georgia Institute of Technology, Woodruff School of Mechanical Engineering

3:25 PM  Student Presentation
11.2 Bias Stress-Induced Interfacial Instability Characterization in Oxidized SiC with Novel Non-contact Approach
M. Wilson, A. Savtchouk, D. Marinskiy, J. Lagowski
Semilab SDI

3:45 PM  Student Presentation
11.3 Eₐ-0.90 eV Trap-Induced Threshold Voltage Instability in GaN/Si MISHEMTs
W. Sun, A.R. Arehart, S.A. Ringel
Department of Electrical and Computer Engineering, Ohio State University

4:05 PM  Student Presentation
11.4 Metrology for In-situ Monitoring of Roughness for Diffusers for Light Emitting Devices Manufacturing
W.J. Walecki¹, P.S. Walecki², E.S. Walecki², A.S. Walecki²
¹Frontier Semiconductors, ²Sunrise Optical LLC

4:25 PM  BREAK
Wednesday, May 24th

SESSION 12: PROCESS - METALLIZATION

Chairs: Chang-Hwang Hua, WIN Semiconductors Corp.  
        Mike Sun, Skyworks Solutions

4:40 PM 12.1 Reduction of Metal Defect Formation through Process Optimization  
        S.J. Mason, T. Valade, J. Chiavetta, D. Edwards  
        Broadcom

5:00 PM 12.2 Study of Target Voltage during DC Magnetron Sputtering  
        J. Yang, C. Weng  
        Qorvo

5:20 PM 12.3 NiCr Sheet Resistance Adjustment during Wafer Fabrication Process  
        L. Luu, M. Chen, A. Vigo  
        Global Communications Semiconductor, LLC.

5:40 PM Student Presentation
12.4 Iridium Plug Technology for AlGaN/GaN HEMT Short-Gate Fabrication  
        K.Y. Osipov, R. Lossy, P. Kurpas, S.A. Chevtchenko, I. Ostermay, J. Würfl, G. Tränkle  
        Ferdinand-Braun-Institut, Leibniz-Institut für Höchstfrequenztechnik (FBH)

7:00 PM SEMI STANDARDS MEETING
SESSION 13: PROCESS – DRY ETCH

Chairs: Heribert Zull, *OSRAM Opto Semiconductors GmbH*
Russ Westerman, *Plasma-Therm, LLC*

4:40 PM 13.1 High Aspect Ratio Vias in Silicon Carbide Etched by Inductively-Coupled Plasma
M.J. Tadjer¹, L.E. Luna², E.A. Imhoff³, T.J. Anderson¹, K.D. Hobart¹, F.J. Kub¹
¹U.S. Naval Research Laboratory, ²National Research Council

5:00 PM 13.2 Epitaxial ScAlN Etch-Stop Layers Grown by Molecular Beam Epitaxy for Selective Etching of AlN and GaN
M.T. Hardy, B.P. Downey, D.J. Meyer, N. Nepal, D.F. Storm, D.S. Katzer
*Electronics Science and Technology Division, U.S. Naval Research Laboratory*

5:20 PM 13.3 Recessing Process for Au-free Ohmic Contacts Formation on AlGaN/GaN Heterostructures with AlN Spacer
A. Constant, J. Baele, P. Coppens, F. De Pestel, P. Moens, M. Tack
*ON Semiconductor, Power Technology Centre, Corporate R&D*

5:40 PM 13.4 Plasma Dicing On Tape for GaAs Based Devices
M. Notarianni, T.-W. Chiang, C. Johnson, R. Westerman, T. Lazerand,
*Plasma-Therm LLC*

7:00 PM **SEMI STANDARDS MEETING**
Thursday, May 25th

SESSION 14: EMERGING TECHNOLOGIES

Chairs: David Meyer, Naval Research Laboratory
Glen “David” Via, Air Force Research Laboratory

8:15 AM Invited Presentation
14.1 Recent Progress of Diamond Devices for Power Applications
M. Kasu
Saga University

8:45 AM 14.2 Growth of Single Crystal Beta-Gallium Oxide (β-Ga₂O₃) Semiconductor Material
J.D. Blevins¹, D. Thomson¹, K. Stevens²
¹Air Force Research Laboratory, ²Northrop Grumman Synoptics

9:05 AM 14.3 Development of Homoeptaxial Growth of Ga₂O₃ by Hydride Vapor Phase Epitaxy
J.H. Leach¹, K. Udwary¹, T. Schneider¹, J.D. Blevins², K.R. Evans¹, Greg Foundos³, K.T. Stevens³
¹Kyma Technologies, ²Air Force Research Laboratory, Sensors Directorate, ³Northrop Grumman Synoptics

9:25 AM 14.4 Device Development of Gallium Oxide MOSFETs Grown by MOVPE on Native Substrates for High-Voltage Applications
N.A. Moser¹,², K.D. Chabak¹, A.J. Green³, D.E. Walker Jr.¹, S.E. Tetlak¹, E. Heller⁴, A. Crespo¹, R.C. Fitch¹, J. McCandless⁵, K.D. Leedy¹, M. Baldini⁵, G. Wagner⁵, G.D. Via¹, J.D. Blevins¹, G. Jessen¹
¹Air Force Research Laboratory, Sensors Directorate, ²Department of Electrical and Computer Engineering, George Mason University, ³Wyle Laboratories, Inc., ⁴Air Force Research Laboratory, Materials and Manufacturing Directorate, ⁵Leibniz-Institut für Kristallzüchtung

9:45 AM BREAK
Thursday, May 25th

SESSION 15: HETEROGENEOUS INTEGRATION
Chairs: Rudiger Schreiner, Consultant
        Judy Kronwasser

8:15 AM Invited Presentation
15.1 Advancing Technology with Heterogeneous Integration
Dr. D. Green
DARPA, MTO

8:45 AM 15.2 Heterogeneous Integration of Microwave GaN Power Amplifiers with Si Matching Circuits
Fujitsu Laboratories Ltd.

9:05 AM 15.3 Growth of In0.30Ga0.70As-Channel Transistor Layers on Large-Scale Si Wafers for Hetero-Integration with Si CMOS
X.S. Nguyen¹, S. Yadav², K.H. Lee¹, D. Kohen¹, A. Kumar², R. I Made¹, X. Gong³, K.E. Lee¹, C.S. Tan¹, S.F. Yoon¹,³, E. Fitzgerald¹,², S.J. Chua¹,²
¹Low Energy Electronic Systems IRG (LEES), ²Department of Electrical and computer engineering, National University of Singapore,³School of Electrical and Electronic Engineering, Nanyang Technological University, ²Department of Materials Science and Engineering, Massachusetts Institute of Technology

9:25 AM Student Presentation
15.4 Cubic Phase GaN Integrated on CMOS-Compatible Silicon (100)
R. Liu, C. Bayram
Department of Electrical and Computer Engineering, University of Illinois at Urbana-Champaign and Micro and Nanotechnology Laboratory, University of Illinois at Urbana-Champaign

9:45 AM BREAK
Thursday, May 25th

SESSION 16: GaN MATERIALS
Chairs: Yohei Otoki, SCIOCS
Russell Kremer, Freiberger Compound Materials

10:20 AM  16.1 Effect of Manufacture on the Microstructure of GaN-on-Diamond
D. Liu¹², D. Francis¹, F. Faili³, J.W. Pomeroy⁵, D.J. Twitchen¹, M. Kuball²
¹Department of Materials, University of Oxford, ²Center for Device Thermography and Reliability (CDTR), University of Bristol, ³Element Six Technologies U.S. Corporation

10:40 AM  Student Presentation
16.2 Scaling AlGaN/GaN High Electron Mobility Transistor structures onto 200-mm silicon (111) Substrates Through Novel Buffer Layer Configurations
H.-P. Lee¹², J. Perozek¹², C. Bayram¹²
¹Department of Electrical and Computer Engineering, University of Illinois at Urbana-Champaign, ²Micro and Nanotechnology Laboratory, University of Illinois at Urbana-Champaign

11:00 AM  16.3 Evaluation of GaN Device Structures on 150 mm GaN on Engineered Substrates
K.D. Hobart¹, T.J. Anderson¹, A.D. Koehler¹, A. Nath², J.K. Hite¹, F.J. Kub¹, O. Aktas³, V. Odnoblyudov³, C. Basceri³
¹U.S. Naval Research Laboratory, ²George Mason University, ³Quora Technology, Inc.

11:20 AM  16.4 Development of Non-Core 4-inch GaN Substrate
H. Osada¹, Y. Yoshizumi¹, K. Uematsu², S. Minobe¹, F. Sato¹, F. Nakanisih¹², Y. Yamamoto⁵, Y. Hagi¹², Y. Yabuhara¹²
¹Sumiden Semiconductor Materials Co., Ltd., ²Sumitomo Electric Industries, Ltd.

11:40 AM  16.5 Epitaxial Lift-Off from Native GaN Substrates using Photoenhanced Wet Etching
C. Youtsey¹, R. McCarthy¹, R. Reddy¹, A. Xie², E. Beam³, J. Wang³, P. Fay³, E. Carlson⁴, L. Guido⁴
¹MicroLink Devices, ²Qorvo, ³University of Notre Dame, ⁴Virginia Tech University

12:00 PM  CS MANTECH LUNCHEON
Thursday, May 25th

SESSION 17: PROCESS CONTROL & YIELD

Chairs: Corey Nevers, Qorvo
        Steve Mahon, Feldman Engineering

10:20 AM  17.1 RF DS Yield Improvement Through ZONAL Technique for pHEMT Product
          Y. Wang¹, P. Hamilton¹, R. Waco¹, J. Middleton¹, F. Barnes¹, A. Choo²
          ¹Qorvo, ²UP! Strategies Consulting

10:40 AM  17.2 Optical Defect Investigation and Drill Down Automation
          E. McCormick¹, C. Hall¹, D. Lupo¹, M. Colorado¹, J. Wong²
          ¹Qorvo, ²BISTel

11:00 AM  17.3 The Mechanism of Cu Seed Residue Formation
          L. Chen, Y. Yang, X. Huang, D. Gonzales, G. Gupta, J. Gibbon, L. Breaux, D. Yue
          Qorvo

11:20 AM  17.4 Four Level Category Commonality and a Loophole in Is/Is Not Analysis
          X. Huang, J. Kwon, E. Clarke, G. Gupta, R. Wands, F. Celii, V. Tran, L. Breaux, J.
          Gibbon, J. Trujillo, K. Mausolf, M. Lube, C. Hall
          Qorvo

11:40 AM  17.5 Chemical Attack of a pHEMT Channel Due to Poor Passivation Coverage
          R. Waco, C. Nevers, R. Emergo, V. Besong
          Qorvo

12:00 PM  CS MANTECH LUNCHEON
Thursday, May 25th

SESSION 18: DIELECTRICS FOR POWER DEVICES

Chair: Shalini Gupta, Northrop Grumman Corporation

1:30 PM 18.1 Link Between Silicon Nitride Stoichiometry, Vertical Epitaxial Conductivity and Current Collapse in GaN/AlGaN Power Devices
W.M. Waller¹, M. Gajda², S. Pandey², J.J.T.M. Donkers², D. Calton², J. Croon², S. Karboyan¹, J. Šonský, M.J. Uren¹, M. Kuball¹
¹University of Bristol, ²NXP Semiconductors

1:50 PM 18.2 Engineering PECVD SiN Passivation Layers to Enable AlGaN/GaN HEMTs with Low Leakage, Low Current Collapse and High Breakdown Voltage
U.S. Naval Research Laboratory

2:10 PM 18.3 Threshold Voltage Control by Tuning Dcharge in ZrO₂ Gate Dielectrics for Normally-off AlGaN/GaN MOS-HEMTs
T.J. Anderson¹, V.D. Wheeler¹, D.I. Shahin², M.J. Tadjer¹, L.E. Luna¹, A.D. Koehler¹, K.D. Hobart¹, F.J. Kub¹, C.R. Eddy, Jr.¹
¹U.S. Naval Research Laboratory, ²University of Maryland

2:30 PM Student Presentation

18.4 TDDB and PBTI Characterizations of Fully-recessed E-mode GaN MIS-FETs with LPCVD-SiN/PECVD-SiNx Gate Dielectric Stack
M. Hua, Q. Qian, J. Wei, Z. Zhang, G. Tang, K.J. Chen
Department of Electronic and Computer Engineering, The Hong Kong University of Science and Technology
Thursday, May 25th

SESSION 19: OPTICAL DEVICES
Chair: Paul Cooke, IQE

1:30 PM  19.1 Manufacturing of 10 GHz InGaAs/InP p-i-n Photodetectors in GaAs Wafer Fabrication facility
D. Pal, L. Elliot, J. Carter
MACOM

1:50 PM  Student Presentation
19.2 Design and Fabrication of High-Speed PIN Photodiodes for 50 Gb/s Optical Fiber Links
A. Winoto, Y.-T. Peng, M. Feng
Department of Electrical and Computer Engineering, University of Illinois at Urbana-Champaign, Micro and Nanotechnology Laboratory

2:10 PM  Student Presentation
19.3 40 Gb/s VCSELs Test Data Collection, Analysis, and Process Problem Identification
J. Qiu, H.L. Wang, C.Y.L. Wang, X. Yu, M. Feng
Department of Electrical and Computer Engineering, University of Illinois at Urbana-Champaign, Micro and Nanotechnology Laboratory

2:30 PM  Student Presentation
19.4 406 MHz Modulation Bandwidth of GaN-based Light-Emitting Diodes with Improved Transparent p-Contact Design
H.-Y. Lan, Y.-Y. Lin, C.-H. Chang, C.-H. Wu
Graduate Institute of Photonics and Optoelectronics, National Taiwan University
Thursday, May 25th

SESSION 20: POSTER
Chair: Nick Kolarich, II-VI EpiWorks

2:50 PM - 4:00 PM

Student Presentation

20.1 AlGaN/GaN High Electron Mobility Transistors with Selective Area Grown p-GaN Gate
X. Yang, Y. Zhang, L. Zhang, Y. Huang, Z. Cheng, H. Lu, J. Li
Institute of Semiconductors, Chinese Academy of Sciences

20.2 A Novel Approach to Fault Detection Using Full Sensor Trace Analytic
T. Ho¹, J. Wong¹, E. McCormick², C. Hall²
¹BISTel, ²Qorvo

20.3 Some Process Development Issues for Ka-band GaN HEMT Individual Source Via (ISV)
Qorvo

20.4 Carbide Coatings for MOCVD Wafer Carrier Protection
H. Qu, W. Fan, S. Natarajan, T. Creighton, G. Shaffer, B. Kozak
Momentive Performance Materials Inc.

Student Presentation

20.5 Characterization of ALD High-k Dielectrics in GaN and Ga₂O₃ Metal-Oxide-Semiconductor Systems
D.I. Shahin¹, T.J. Anderson², V.D. Wheeler², M.J. Tadjar², L.E. Luna², A.D. Koehler², K.D. Hobart², C.R. Eddy, Jr.², F.J. Kub², A. Christou¹
¹University of Maryland, ²U.S. Naval Research Laboratory

20.6 Improving Process Tool Productivity by Correct Sealing Material Selection for Plasma Processes
M. Gulcur, K. Beekmann
IDEX Sealing Solutions – Precision Polymer Engineering Ltd.

Continued on Next Page
Thursday, May 25th

SESSION 20: POSTER - Continued
Chair: Nick Kolarich, II-VI EpiWorks

2:50 PM - 4:00 PM

20.7 Process Condition Optimization for High Throughput and High Efficiency Growth of the AlGaN/GaN HEMT structure in a Single Wafer Rotating Disc MOCVD Reactor
B. Mitrovic, R. Bubber, M. Deshpande, E. Marcelo, J. Su, R. Arif, A. Paranjpe
Veeco MOCVD Operations

20.8 Thick (6µm) n-type GaN-on-Si Epi-Layers for Vertical Power Devices
L. Zhang, P. Xiang, K. Liu, H. Huo, H. Ding, N. Yin, K. Cheng
Enkris Semiconductor, Inc.

Student Presentation

20.9 Low Leakage High Breakdown GaN MOSHEMTs on Si with a ZrO₂ Gate Dielectric
Department of Electronic and Computer Engineering, Hong Kong University of Science and Technology

20.10 Overcoming High Power Limitation of Thin Film Resistors at GHz Frequencies Using CVD Diamond Substrates
J. Anaya¹, T. Obeloer², D.J. Twitchen²
¹J.Anaya Scientific Consultancy, ²Element Six

Student Presentation

20.11 Comparison Emitter Edge Roughness Mitigation by Ion-Milling and Ion-Sputtering of EBL Defined Metallizations in InP/GaAsSb DHBTs
W. Quan, R. Flueckiger, M. Alexandrova, O. Ostinelli, C. R. Bolognesi
Millimeter-Wave Electronics Group, ETH-Zuerich

20.12 Backside Via Process with Defect Free Sidewalls for GaN MMIC Applications
ETRI (Electronics and Telecommunications Research Institute)
**Thursday, May 25th**

**CONFERENCE CLOSING**

4:10 PM  **Closing Reception & Award Presentations**  
Best Poster Session Paper  
CS MANTECH Scavenger Hunt Winner  
Conference Feedback Raffle Prize Drawing

**Conference Closing** –  
Celicia Della-Morrow, Conference Chair  
Qorvo
GENERAL INFORMATION

2017 International Conference on Compound Semiconductor Manufacturing Technology
May 22nd – 25th, 2017

Hyatt Regency Indian Wells Resort & Spa
44600 Indian Wells Lane
Indian Wells, California, USA 92210

REGISTRATION INFORMATION (US$)

For Conference Registration, register online at www.csmantech.org. Register by April 20th to take advantage of our Early Bird Rate.

www.csmantech.org

<table>
<thead>
<tr>
<th>Pricing</th>
<th>Through Apr 20</th>
<th>After Apr 20</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regular Conference Registration 1)</td>
<td>$595</td>
<td>$695</td>
</tr>
<tr>
<td>Student Conference Registration 2)</td>
<td>$125</td>
<td>$125</td>
</tr>
<tr>
<td>Government Conference Registration 1)</td>
<td>$595</td>
<td>$595</td>
</tr>
<tr>
<td>1-Day Conference Registration (May 23rd) 3)</td>
<td>$300</td>
<td>$300</td>
</tr>
<tr>
<td>1-Day Conference Registration (May 24th)</td>
<td>$300</td>
<td>$300</td>
</tr>
<tr>
<td>1-Day Conference Registration (May 25th)</td>
<td>$300</td>
<td>$300</td>
</tr>
<tr>
<td>1-Day Exhibits Only Registration (May 23rd or May 24th)</td>
<td>$100</td>
<td>$100</td>
</tr>
<tr>
<td>Workshop Registration (May 22nd)</td>
<td>$175</td>
<td>$275</td>
</tr>
<tr>
<td>Government Workshop Registration (May 22nd)</td>
<td>$175</td>
<td>$175</td>
</tr>
<tr>
<td>Ticket for International Reception (May 23rd)</td>
<td>$75</td>
<td>$75</td>
</tr>
</tbody>
</table>

1) Does not include Workshop Registration Fee
2) Includes Workshop Registration Fee
3) Does not include International Reception Ticket

Payment of the regular, student, or government conference registration fee includes:

- One copy of the printed Conference Digest (You may ‘opt-out’ or choose to not receive a printed digest by clicking on the check-box at bottom of registration site when completing your registration information. **Registration after the Early Bird Date will not include a copy of the printed Conference Digest**)
- Access to the 2017 Online Conference Digest
- Access to the 2017 Conference Papers through the CS MANTECH mobile app
- Admission to all technical sessions and the exhibits
- One International Reception (IR) ticket
- Access to the Exhibits Reception, the Exhibits Luncheon, the Panel Session, the Poster Session and Conference Closing Reception, the buffet breakfasts, and refreshment breaks

**NOTE:** Digital copies of the 2017 Conference Papers will not be offered on USB portable memory sticks. Conference Papers will be available for download
and viewing from our 2017 online digest site using an access code that will be provided at the conference.

The **one-day registration** includes:
- Admission to all sessions, to the Exhibits Hall, buffet breakfast, and break refreshments for that day only
- Printed Conference Digest (you may ‘opt-out’ or choose to not receive a printed digest by clicking on the check-box at bottom of registration site when completing your registration information. **Registration after the Early Bird Date will not include a copy of the printed Conference Digest**)
- Access to the 2017 Online Conference Digest
- Access to the 2017 Conference Papers through the CS MANTECH mobile app
- Included in the Tuesday-only registration is the Exhibits Lunch (NOTE: **Tuesday’s one-day registration does not include admission to the International Reception**. Tickets for the International Reception can be purchased separately through the registration site or at the conference pending ticket availability)
- Included in the Thursday-only registration is the CS MANTECH Luncheon as well as the Poster Session and Conference Closing Reception

**NOTE:** The one-day registration option can be taken only once during the conference (no multiple one-day registrations).

Payment of the workshop registration includes one copy of the Workshop Digest, breakfast, Workshop Luncheon and break refreshments. Additional copies of the Workshop Notes may be purchased for $100.

Registrants may pay by credit card. The only acceptable credit cards are Master Card, VISA, and American Express. **REGISTRATION WITHOUT PAYMENT WILL NOT BE ACCEPTED.** All refund requests must be received by Travis Abshere at the CS MANTECH office shown below by April 20th for a full refund less a $25 processing fee. **NO REFUNDS AFTER April 20th, 2017.**

CS MANTECH  
14525 SW Millikan Way #26585  
Beaverton, Oregon 97005-2343

For Advanced Conference Registration, register online at our Web Site on or before the **Early Bird Date of April 20th, 2017.**  

[www.csmantech.org](http://www.csmantech.org)
HOTEL RESERVATIONS

CS MANTECH has arranged for a discounted nightly rate at the Hyatt Regency Indian Wells Resort & Spa. The rate for single or double occupancy is **$179 per night**, exclusive of state and local taxes (which are currently 14.25%, and a $0.57 nightly state assessment for tourism).

The CS MANTECH rate includes **free guest room Internet access**. For those wishing to extend their stay, a limited number of rooms are available at the group rate three days before and after the conference on a first come, first served basis.

A minimum of 72 hours notice prior to arrival is required for all guestroom cancellations without penalty. Any cancellations within the 72-hour period will be subject to a charge of one room night and any applicable taxes.

Hotel reservations:
- The Hyatt Regency Indian Wells Resort & Spa recommends using the Passkey web-based registration that has been set up for the conference. You can access this web link by visiting the CS MANTECH website (www.csmantech.org) and clicking on the Hyatt Regency link on the homepage.
- If you call the hotel directly, please request the CS MANTECH group rate to receive the CS MANTECH discounted rate.

**The cut-off date for making a reservation at the Hyatt Regency Indian Wells Resort & Spa at the CS MANTECH rate is April 20, 2017.** Reservations made after this date will be subject to availability and to the prevailing rates at the Hyatt Resort.

If you require the US Government rate (ID required, prevailing per diem rate), please visit http://csmantech.org/hotel-government-rate-request/ to request the rate.

The discounted rate is subject to availability, so please MAKE YOUR RESERVATION EARLY!

We ask you to please support CS MANTECH and to enjoy all of the conference activities by staying at our official 2017 location, the Hyatt Regency Indian Wells Resort & Spa.
CONFERENCE REGISTRATION & INFORMATION CENTER

Conference registration is located at the registration counter in the Indian Wells Convention Center across the Hotel Lobby.

MESSAGE BOARD

A Conference Message Board will be maintained at the Registration & Information Center during registration hours. Please advise callers who wish to reach you during the day to ask the hotel operator to deliver a message to the CS MANTECH Conference Registration Desk. Please check the message board periodically.

THE CONFERENCE HOTEL

Located just 20 minutes outside of Palm Springs, the Hyatt Regency Indian Wells Resort & Spa offers a sophisticated setting enriched by the elegant California desert ambiance. Guests will enjoy premium amenities at Hyatt Regency’s classic resort in Palm Springs, including a top-rated spa, championship golf courses, tennis courts, swimming pools, and private poolside cabanas.

TRANSPORTATION TO THE HOTEL

The Hyatt Regency Indian Wells Resort & Spa can be reached by car, taxi or shuttle bus from the following airports:

- **Palm Springs International Airport (PSP)**, distance to Hyatt Regency Indian Wells Resort & Spa: 15 miles, 30-40 minutes.
- **Ontario International Airport (ONT)**, distance to Hyatt Regency Indian Wells Resort & Spa: 86 miles, 1.5 hours.
- **Los Angeles International Airport (LAX)**, distance to Hyatt Regency Indian Wells Resort & Spa 140 miles, 2.5 hours

Shuttle and taxi options at the Palm Springs International Airport are listed below:

- Shuttle Companies
  - AM/PM Shuttle Service - 760.409.8826
  - Lions School Shuttle Services, Inc.- 714.606.4736
  - Transit Van Shuttle - 951.719.3274
The concierge team at The Hyatt Regency Indian Wells Resort & Spa can assist attendees with making reservations in advance for airport transportation to and from Palm Springs International Airport, Ontario International Airport and Los Angeles International Airport (LAX).

The Hyatt Regency Indian Wells Resort & Spa also offers the following parking options:

- Self Parking – Cost: $11.00 daily
- Valet Parking – Cost: $27.00 daily

Car services such as Uber and Lyft are available as well. Please use the appropriate app or visit the service’s website for details.

FINANCIAL ASSISTANCE

CS MANTECH encourages presentations and participation by academic delegates. To support this participation, limited funding is available to support travel and conference attendance by student presenters. Requests will be considered on a first-come, first-served basis. Please see www.csmantech.org/students/students for details regarding the guidelines and requirements on applying for financial assistance. Requests or questions may be sent to the CS MANTECH University Liaison at student.aid@csmantech.org.
2017 CS MANTECH CONFERENCE
FLOOR MAP

Hyatt Regency Indian Wells Resort & Spa
Conference Center
2017 CONFERENCE SPONSORS
(Sponsor list confirmed at press)

Platinum Sponsors

Skyworks, Inc.
Plasma-Therm, LLC
Virginia Diodes, Inc.
Wolfspeed
Itochu Plastics, Inc.
SCIOCS

Gold Sponsors

n&k Technology, Inc.
Brewer Science, Inc.
The MAX Group
SPTS Technologies
WIN Semiconductors Corporation
Freiberger
Accel-RF Corporation
MACOM
Sumika Materials
SawStreet
Lam Research

Silver Sponsors

Qorvo
CMK

Media Sponsors

Semiconductor Today
CS Magazine