



TECHNICAL PROGRAM

International Conference on Compound Semiconductor Manufacturing Technology

May 7th – 10th, 2018
www.csmantech.org



**Hyatt Regency
Austin, Texas, USA**
CONFERENCE AT A GLANCE

SUNDAY, May 6th

6:00 PM – 8:00 PM

REGISTRATION
REG Counter

MONDAY, May 7th

7:00 AM – 7:00 PM	CS MANTECH REGISTRATION <i>REG Counter</i>
7:00 AM – 8:30 AM	ROCS REGISTRATION <i>Texas Ballroom Foyer</i>
7:00 AM – 8:30 AM	CS MANTECH & ROCS WORKSHOP BREAKFAST <i>Texas Ballroom 1</i>
8:00 AM – 5:00 PM	CS MANTECH WORKSHOPS <i>Texas Ballroom 1</i>
8:30 AM – 5:00 PM	ROCS WORKSHOP <i>Texas Ballroom 2-3</i>
11:30 AM – 1:00 PM	CS MANTECH & ROCS WORKSHOP LUNCHEON <i>Texas Ballroom Foyer</i>
6:00 PM – 9:00 PM	EXHIBITS RECEPTION <i>Zilker Ballroom</i>

TUESDAY, May 8th

7:00 AM – 5:00 PM	REGISTRATION <i>REG Counter</i>
7:00 AM – 8:00 AM	BREAKFAST <i>Zilker Ballroom</i>
8:00 AM – 8:30 AM	OPENING CEREMONIES <i>Texas Ballroom 1-7</i>
8:00 AM – 5:30 PM	EXHIBIT HOURS <i>Zilker Ballroom</i>
8:30 AM – 10:30 AM	SESSION 1: PLENARY I <i>Texas Ballroom 1-7</i>
10:30 AM – 11:00 AM	BREAK <i>Zilker Ballroom</i>
11:00 AM – 12:00 PM	SESSION 1: PLENARY I <i>Texas Ballroom 1-7</i>
12:00 PM – 1:30 PM	EXHIBITS LUNCH <i>Zilker Ballroom</i>
1:30 PM – 3:20 PM	SESSION 2: PACKAGING AND HETEROGENEOUS INTEGRATION <i>Texas Ballroom 1-7</i>
3:20 PM – 4:00 PM	BREAK <i>Zilker Ballroom</i>
4:00 PM – 5:30 PM	SESSION 3: RF DEVICES

Texas Ballroom 1-7

- 5:45 PM – 6:45 PM **STUDENT FORUM**
Zilker Terrace
- 5:45 PM – 6:45 PM **EXHIBITOR FORUM**
Hill Country A-D
- 7:15 PM – 10:00 PM **INTERNATIONAL
RECEPTION**
The Speakeasy

WEDNESDAY, May 9th

- 7:00 AM – 5:00 PM **REGISTRATION**
REG Counter
- 7:00 AM – 8:00 AM **BREAKFAST**
Zilker Ballroom
- 8:00 AM – 11:00 AM **EXHIBIT HOURS**
Zilker Ballroom
- 8:00 AM – 9:50 AM **SESSION 4: PROCESS
CONTROL AND YIELD**
Texas Ballroom 1-3
- 9:50 AM – 10:20 AM **BREAK**
Zilker Ballroom
- 10:20 AM – 12:20 AM **SESSION 5:
CHARACTERIZATION OF
GAN DEVICES**
Texas Ballroom 1-3
- 10:20 AM – 12:20 AM **SESSION 6: BUSINESS AND
USE CASES**
Texas Ballroom 4-7
- 12:20 AM – 1:30 PM **OPEN**
*Lunch at your own leisure or
time to explore Austin*
- 1:30 PM – 3:30 PM **SESSION 7: GaN EPITAXY
AND MATERIALS**
Texas Ballroom 1-3
- 1:30 PM – 3:30 PM **SESSION 8:
OPTOELECTRONICS**
Texas Ballroom 4-7
- 3:30 PM – 4:00 PM **BREAK**
Texas Ballroom Foyer
- 4:00 PM – 5:50 PM **SESSION 9: PROCESSING:
RESIST & ETCH**
Texas Ballroom 1-3

4:00 PM – 5:40 PM **SESSION 10: ACOUSTIC FILTERS**
Texas Ballroom 4-7

6:00 PM – 8:00 PM **RUMP SESSIONS**
Hill Country A-D

7:00 PM – 9:00 PM **SEMI STANDARDS MEETING**
Footills 1

THURSDAY, May 10th

7:00 AM – 9:30 AM **REGISTRATION**
REG Counter

7:00 AM – 8:00 AM **BREAKFAST**
Texas Ballroom 4-7

8:00 AM – 9:50 AM **SESSION 11: TEST AND RELIABILITY**
Texas Ballroom 1-3

9:50 AM – 10:20 AM **BREAK**
Texas Ballroom Foyer

10:20 AM – 12:30 PM **SESSION 12: MANUFACTURING**
Texas Ballroom 1-3

12:00 PM – 1:30 PM **CS MANTECH LUNCH**
Texas Ballroom 4-7

1:30 PM – 3:40 PM **SESSION 13: POWER DEVICES**
Texas Ballroom 1-3

3:40 PM – 4:30 PM **SESSION 14: POSTER SESSION**
Zilker Ballroom 1-2

4:30 PM – 5:30 PM **CLOSING RECEPTION**
Zilker Ballroom 1-2

2018 CONFERENCE HIGHLIGHTS

On behalf of the Technical Program Committee for the 2018 CS MANTECH Conference, it is my pleasure to welcome you to this year's conference, and to thank you for participating. This year's technical program promises to be excellent, with a wide array of both invited and contributed talks across the breadth of topics relevant to compound semiconductor manufacturing. Here are a few highlights of the program:

Monday, May 7th:

- Continuing the CS-MANTECH tradition, the program begins this year with a series of tutorial workshops.
- 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 Exhibits Reception. The CS MANTECH exhibits are an excellent opportunity to visit 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 8th:

- The CS MANTECH Conference formally begins in the morning with opening ceremonies that include the 2017 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 plenary session. The plenary will feature three prominent invited industry speakers from across the spectrum of the CS industry, including optoelectronics (Andreas Weimar from OSRAM), devices for automotive applications (Kamal Khouri from NXP), and GaN for power (Umesh Mishra from UCSB and Transphorm).
- After lunch in the Exhibits Hall, we will reconvene for two additional technical sessions featuring invited talks on Packaging and Heterogeneous Integration, as well as RF Devices.
- Tuesday afternoon's technical sessions will conclude with the Exhibitors' Forum and Student Forum. The Exhibitors' Forum provides an opportunity for exhibitors to present marketing/technical presentations to conference attendees, while 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 Austin Speakeasy (<http://speakeasyaustin.com>).

Wednesday, May 9th:

- Wednesday morning begins with breakfast in the Exhibits Hall where attendees can follow up on questions from the Exhibitors' Forum or meet with a few more 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, with time to explore Austin.
- Parallel sessions continue in the afternoon starting at 1:30 pm.
- At 6:00 pm, the Rump Session will start, consisting of 4 parallel topics. These informal sessions thrive on audience participation, so join in the fun by voicing your thoughts on the topics.
- At 7:00 pm the SEMI Standard Meeting will be held.

Thursday, May 10th:

- Thursday morning continues with technical sessions starting at 8:00 am.
- At 12:30 pm, all conference attendees are invited to join us for the CS MANTECH Conference Luncheon.
- After lunch, we will hold our last technical session followed by the poster session. The Closing Reception features prizes for this year's conference contest, as well as for best poster and conference feedback. Conference feedback will be submitted using our Mobile Application. Come see the posters, join the contest, and enjoy our conference Closing Reception.

Thank you again for being part of this year's conference and welcome to Austin!

Patrick Fay, Technical Program Chair
University of Notre Dame

2018 CS MANTECH WORKSHOP

Monday, May 22nd, 2017
8:00 a.m. – 5:00 p.m.

2017 ROCS WORKSHOP

Reliability **O**f **C**ompound **S**emiconductors

Monday, May 22nd, 2017
8:30 a.m. – 5:00 p.m.

The 33rd annual ROCS Workshop will be held in conjunction with the CS MANTECH Conference on Monday May 7th, 2018, at the Hyatt Regency in Austin, Texas, 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.

INDUSTRY EXHIBITS

2018 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, May 7th**, in the exhibition hall (Zilker Ballroom). The exhibits will also be open all day Tuesday, May 8th through Wednesday morning, May 9th 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 for one hour on Tuesday 5:45pm - 6:45pm in the Hill Country Ballroom A, B, C, and D.** (*Schedule of exhibitors are listed at the end of the Conference Guide*). These events provide participating exhibitors an opportunity to more fully showcase their products and services.

INTERNATIONAL RECEPTION

The always enjoyable International Reception visits The Speakeasy on Tuesday evening May 8th 2018 from 7:15-10:00p.m. The location is nice walk less than a mile down the famous Congress Avenue Bat Bridge from the Hyatt. The Speakeasy is composed of three levels, the Music Lounge (where a live band will play), the Mezzanine overlooking the stage, and the rooftop lounge Terrace59. Please plan to join us at the Speakeasy for a fun evening of live music featuring the Cap City Band and Austin culture with a 1920's prohibition era vibe that also happens to be on the Haunted Austin Tour. <http://speakeasyaustin.com> 412 Congress Ave, Austin, TX 78701.

SEMI STANDARDS MEETING

The SEMI Standards meeting is scheduled for Wednesday May 9th, 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.

TECHNICAL PROGRAM

Monday, May 7th

CS MANTECH WORKSHOPS

*“Big Data - Data Storage – Data Retrieval –
Machine Learning”*

Chair: Thorsten Saeger, *Qorvo*

- 7:00 AM **REGISTRATION**
- 7:30 AM **WORKSHOP BREAKFAST**
(CS MANTECH & ROCS)
- 8:00 AM **Workshop sessions, more info coming**
- 5:00 PM **WORKSHOP CLOSING**
- 6:00 PM **EXHIBITS RECEPTION**

ROCS WORKSHOP

Chair: Martin Kuball, *University of Bristol*

- 7:00 AM - 8:30 AM ROCS Registration
- 7:30 AM – 9:00 AM **WORKSHOP BREAKFAST**
(CS MANTECH & ROCS)
- 8:30 AM - 11:30 PM ROCS Workshop Sessions
- 11:30 PM – 1:00 PM **WORKSHOP LUNCH**
(CS MANTECH & ROCS)
- 1:00 PM – 5:00 PM ROCS Workshop Sessions
- 6:00 PM **EXHIBITS RECEPTION**

Tuesday, May 8th

CONFERENCE OPENING

- 8:00 AM **Opening Ceremonies**
Drew Hanser, Conference Chair
Veeco Instruments, Inc.
- 8:10 AM **2017 Conference Best Paper Awards**
Drew Hanser, Conference Chair
Veeco Instruments, Inc.
- 8:20 AM **Technical Program Highlights**
Patrick Fay, Technical Program Chair
University of Notre Dame

SESSION 1: PLENARY

- Chairs: Drew Hanser, *Veeco Instruments, Inc.*
 Patrick Fay, *University of Notre Dame*
- 8:30 AM *Invited Presentation*
**1.1 Innovated volume production for III-V
Compound Semiconductor LED and
Laserchips at OSRAM Opto
Semiconductors**
Andreas Weimar
- 9:30 AM *Invited Presentation*
**1.2 Automotive Industry Trends and Their
Impact on the Future Vehicle**
Kamal Khouri
- 10:30 AM **BREAK**
- 11:00 AM *Invited Presentation*
**1.3 Looking for reliability and high
performance in RF and power conversion
applications? Use GaN.**
Umesh Mishra, *University of California Santa
Barbara*

12:00 PM **EXHIBITS LUNCH**

SESSION 2: Packaging and Heterogeneous Integration

- Chairs: Andy Carter, *Teldyne Scientific & Imaging*
 Barry Wu, *Keysight Technologies*
- 1:30 PM *Invited Presentation*
**2.1 Additive manufacturing solutions to
mm-wave heterogenous circuits**
Jean-Mark Rollin
Nuvotronics

- 2:00 PM **2.2 Interfacial strength and fracture toughness in bonded semiconductor materials**
 Don Lui¹, Naoteru Shigekawa², Martin Kuball³
¹University of Oxford, ²Osaka City University, ³University of Bristol
- 2:20 PM **BREAK**
- 2:50 PM *Invited Presentation*
2.3 Photosensitive Glass-Ceramics for Heterogeneous Integration
 Jeb H. Flemming
3D Glass Solutions
- 3:20 PM *Invited Presentation*
2.4 Heterogeneous Integration Technologies for Next-Generation RF and mm-Wave Subsystems
 Florian Herrault
HRL Laboratories
- SESSION 3: RF Devices**
 Chairs: Mitsuhiro Nakamura, *Sony*
 Yorito Ota, *National Chiao Tung University*
- 4:00 PM **3.1 A 15 W/mm GaN Technology for C-band Pulsed Radars with 45% PAE**
 Gabriele Formicone
Integra Technologies, Inc.
- 4:20 PM **3.2 Impact of Threshold Voltage Variation on RF Performance of 140 nm GaN MMICs**
 Robert C Fitch¹, James K. Gillespie¹, Andrew J. Green², Dennis E. Walker¹, D. Frey³, J Gassman³, Mark Walker³, Gregg H. Gessen¹
¹Sensors Directorate, Air Force Research Laboratory, ²Wyle Laboratories, ³Cobham Defense Systems
- 4:40 PM **3.3 Novel approach for ED transistors integration in GaN HEMT technology**
 Konstantin Y. Osipov, Hans-Joaquin Würfl, Ina Ostermay, Frank Brunner, Gunter Tränkle
Ferdinand-Braun-Institut, Leibniz-Institut für Höchstfrequenztechnik (FBH)
- 5:00 PM **3.4 An Improved 0.25 μ m GaN on SiC MMIC Technology for Radar and 5G Applications**
 Yi-Wei Lien, Wayne Lin, Richard Jhan, Jih-Han Du, Andy Tseng, Wei-Chou Wang, Fan-Hsiu Wang, Clement Huang, Shinichiro Takatani, Walter Wohlmuth

WIN Semiconductors Corp.

5:20 PM **3.5 Advanced BiHEMT Technology with
Quarter-um Enhancement Mode pHEMT
for sub-6GHz HPUE PA Application**
Cheng Shao Chang
WIN Semiconductors Corp.

5:45 PM **STUDENT FORUM**

5:45 PM **EXHIBITOR FORUM**

7:15 PM **INTERNATIONAL RECEPTION**
The Speakeasy
(Less than a mile walk from the hotel)

Wednesday, May 9th

SESSION 4: Process Control and Yield

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

8:00 AM **4.1 SPC Process Revitalization in a High Mix Low Volume Fab**

Jay D. Alexander, Eric Finchem, James Carter
MACOM

8:20 AM **4.2 Mechanism and Resolution of Implant Induced ESD Damage in GaAs IC Processing**

Lam T. Luu-Henderson, Mehran Janani, John Bonk, Steve Canale, Mark Borek
Skyworks Solutions, Inc.

8:40 AM **4.3 Systematic Data Mining Approaches for Yield Improvement**

Yiping Wang, Pat Hamilton, Robert Waco, Matthew Porter, Corey Nevers, Jeremy Middleton
Qorvo Inc.

9:00 AM **4.4 Plating Defect Detection and Process Control**

Volodymyr Bondarenko, William Branoff, Michael Meeder
Qorvo Inc.

9:20 AM **4.5 Mass-Production of High Reliability GaN HEMT for Wireless Communication**

Fumikazu Yamaki, Seigo Sano
Sumitomo Electric Device Innovations, Inc.

9:50 AM **BREAK**

SESSION 5: CHARACTERIZATION OF GAN DEVICES

Chairs: Yohei Otoki, *SCIOCS*
Karen Moore, *NXP*

10:20 AM **5.1 Thermal Analysis of GaN-HEMT/SiC on Diamond by Surface Activated Bonding**

Naoya Okamoto, Yuichi Minoura, Motonobu Sato, Toshihiro Ohki, Shiro Ozaki, Kozo Makiyama, Atsushi Yamada, Junji Kotani, Kazukiyo Joshin, Norikazu Nakamura
Fujitsu Limited and Fujitsu Laboratories Ltd.

10:40 AM *Student Presentation*

5.2 Device-to-device coupling via lateral conduction within the epitaxy in C-doped AlGaIn/GaN HEMTs

Manikant¹, Serge Karboyan¹, Michael J. Uren¹, Kean Boon Lee², Zafar Zaldi², Peter Houston², Martin Kuball¹

¹University of Bristol, ²University of Sheffield

11:00 AM **5.3 Influence of Substrate Removal on the Electrothermal Characteristics of AlGaN/GaN Membrane High Electron Mobility Transistors**

Marko Tadjer¹, Peter Raad², Tatyana Feygelson¹, Andrew Kohler¹, Travis Anderson¹, Bradford Pate¹, Karl Hobart¹, Fitz Kub¹

¹Naval Research Laboratory, ²TMX Scientific and Southern Methodist University

11:20 AM *Student Presentation*

5.4 Performance and Stability of Enhancement-mode Fully-recessed GaN MIS-FETs and Partially-recessed MIS-HEMTs with PECVD-SiNx/LPCVD-SiNx Gate Dielectric

Jiabei He, Mengyuan Hua, Zhaofu Zhang, Gaofei Tang, Kevin J. Chen,
The Hong Kong University of Science and Technology

11:40 AM *Student Presentation*

5.5 Modification of amorphous-SiNx/GaN Interface Trap Density by Nitridation: A First-Principles Calculation Study

G. Zhaofu Zhang, Mengyuan Hua, Jaibei He, Qingkai Qian, Kevin J. Chen
The Hong Kong University of Science and Technology

12:00 PM **5.6 Non-contact Characterization of Bias Stress-Induced Instability of 2DEG in SiN/AlGaN/GaN Structures**

Marshall Wilson, Alexandre Savtchouk, Andrew Findlay, Carlos Almeida, Jacek Lagowski
Semilab SDI

SESSION 6: BUSINESS AND USE CASES

Chair: Gerhard Schoenthal, *Virginia Diodes*
Hidetoshi Kawasaki, *Sony*

10:20 AM *Invited Presentation*

6.1 III-V for Logic Applications: A Design Perspective

Saurabh Sinha
Arm Inc.

10:50 AM *Invited Presentation*

6.2 The Case for All Digital Beamforming
Bror Peterson
Qorvo

- 11:20 AM *Invited Presentation*
**6.3 The Status of the U.S. Integrated
Circuit Design and Manufacturing
Industry**
Brad Botwin
*U.S. Department of Commerce, Bureau of
Industry and Security*
- 11:50 AM **6.4 How have we continued GaAs RFIC
business in Japan ? New Japan Radio
survival history**
Shigeki Yamaga, Hiroguki Yoshinaga,
Takehiko Kameyama
New Japan Radio Co., Ltd
- 12:20 AM **OPEN**
Lunch at your own leisure, with time to
explore Austin

SESSION 7: GAN EPITAXY AND MATERIALS

Chairs: Chris Santana, *IQE*
Judy Kronwasser, *NOVASIC*

- 1:30 PM *Invited Presentation*
7.1 Real potential of GaN electric devices coming from GaN on GaN
Yohei Otoki
SCIOCS
- 2:00 PM **7.2 An Analysis of the Surface Morphology of the GaN-on-GaN Epi Wafers and the Control by the Substrate Off Angle**
Fumimasa Horikiri¹, Yoshinobu Narita¹, Takehiro Yoshida¹, Chikashi Ito², Varun Gupta², Anoop Somanchi²
¹*SCIOCS*, ²*KLA Tencor*
- 2:20 PM *Invited Presentation*
7.3 RF GaN/Si HEMT Growth Development Using Single Wafer MOCVD Technology
Ming Pan, Soo-Min Lee, Jie Su, Eric Tucker, Randir Bubber, Somit Joshi, Ajit Paranjpe
Veeco Instruments
- 2:50 PM **7.4 High quality AlGaIn/GaN HEMT for RF applications on cold-split thinned 4H-SiC substrates**
Stefano Leone¹, Birte-Julia Godejohan¹, Peter Brueckner¹, Lutz Kirste¹, Christian Manz¹, M. Swobada², C. Beyer², Jan Richter², Ruediger Quay¹
¹*Fraunhofer IAF*, ²*Sillectra GmbH*
- 3:10 PM **7.5 Innovative GaN based engineered substrates for power applications**
Eric Guiot
SOITEC.

SESSION 8: OPTOELECTRONICS

Chairs: Kevin Stevens, *IQE*
Ruediger Schreiner

- 1:30 PM *Invited Presentation*
8.1 Advances in MOCVD Technology for III-V Photonics
Eric A. Armour
Veeco Instruments, Inc.
- 2:00 PM **8.2 Status of VCSEL growth by multi-wafer production MBE at IntelliEPI**
Juan Li, Shannon M. Hill, Joseph A. Middlebrooks, Chen-Yu Chen, Wei Li, Jenn-Ming Kuo, Kevin W. Vargason, Yung-Chung Kao, Paul R. Pinsukanja

Intelligent Epitaxy Technology, Inc.

- 2:30 PM *Student Presentation*
8.3 Controlling Impurity-Induced Disordering Via Mask Strain for High-Performance Vertical-Cavity Surface-Emitting Lasers
Patrick Su, Thomas O'Brien Jr., Fu-Chen Hsiao, John M. Dallesasse
University of Illinois at Urbana-Champaign
- 2:50 PM *Student Presentation*
8.4 Zinc-induced mirror disordering for high-speed 850 nm VCSEL operated at 40 GB/s OOK
Chun-Yen Peng, Chao-Hsin Wu, Shan-Fong Leong, Gong-Ru Lin, Cheng-Ting Tsai
National Taiwan University
- 3:10 PM *Invited Presentation*
8.5 Manufacturing of lasers and photodetectors on 100mm InP in GaAs IC fabrication facility
Debdas Pal, James Carter, Liza Elliot, Deylin Zhao
MACOM
- 3:30 PM **BREAK**
- SESSION 9: PROCESSING: RESIST AND ETCH**
Chairs: Hermann Stieglauer, *United Monolithic Semiconductors GmbH*
Heribert Zull, *Osram*
- 4:00 PM **9.1 0.20 μm gate length formation technology by using i-line stepper exposure and chemical shrink process**
Takahiro Ueno
Mitsubishi Electric Corporation
- 4:20 PM **9.2 Impact of Loading Effect on Retrograde Profile of CAMP Negative Photoresist in Metal Lift-off Applications**
Sarang Kulkarni, Tom Brown, Shiban Tiku, Manjeet Singh
Skyworks Solutions, Inc.
- 4:40 PM **9.3 Evolution and Challenges of a TaN Resistor Lift-off Process from a Lithography Perspective**
Tom Brown, Sarang Kulkarni, Shiban Tiku, Manjeet Singh
Skyworks Solutions, Inc.

5:00 PM **9.4 Extending MTBC to High Productive Performance Levels in ICP SiN Etching for Advanced RF Applications**

Elena B. Woodard¹, Daniel K. Berkoh¹,
Stephen Vargo², Miki Takagi², Michael
Blair²

¹*Skyworks Solutions, Inc.*, ²*SPTS
Technologies, Inc.*

5:20 PM *Invited Presentation*
9.5 Neutral Beam Technology for Damage-free Etching Processes

Seiji Samukawa
Tohoku University

SESSION 10: ACOUSTIC FILTERS

Chairs: Shalini Gupta, *Northrup Grumman*
Thorsten Saeger, *Qorvo*

4:00 PM *Invited Presentation*
10.1 High Frequency, High Power, Low Loss, Wideband BAW Filters Using Single Crystal AlN-on-SiC Resonators

Ramakrishna Vetury, Jeffrey Shealy, Michael
D. Hodge, Shawn Gibb, Mary Winters, Pinal
Patel, Michael A McLain, Ya Shen, Daeho
Kim, Ken Fallon, Rohan Houlden, David
Aichele
Akoustis

4:30 PM *Invited Presentation*
10.2 Recent Advances in Bulk Acoustic Wave Filter Device Performance and Miniaturization

Paul Stokes, Gernot Fattinger, Fabian
Dumont, Ralph Rothemund, Alexandre
Volatier, Robert Aigner, Erika Fuentes,
Thomas Russel, Vishwasu Potdar, Bang
Nguyen, Buu Diep, Robert Kraft
Qorvo

5:00 PM **10.3 Copy, Scale, Develop, and Match - A Methodology for 200mm Bulk Acoustic Wave Filter Pilot Production Line Start up at Qorvo**

Xiaokang Huang, Charles Dark, Mike
McClure, Buu Diep, Craig Hall, Harold Isom,
Donna Mortensen
Qorvo

5:20 PM *Student Presentation*
10.4 Impact of device parameter on performance of SAW resonators on AlN/sapphire

Shuai Yang, Yun Zhang
*Institute of Semiconductors, Chinese
Academy of Sciences*

6:00 PM **RUMP SESSIONS**

Rump session A: Chinese Compound Semiconductor Foundries Update

Moderator: Marty Brophy

Fabless semiconductor companies abound in the Si world, but have not yet been widely seen in compound semiconductors. Will the new CS fabs in China change that? Can you take your design to market without the expense of a fab? Come and bounce around ideas with other interested attendees over drinks before you quit your day job!

Rump session B: 5G – Why aren't you fabricating devices?

Moderator: Gerhard Schoenthal

5G will be slapped on boxes and devices starting this year. Your smart thing may show it in the upper right or left hand corner of the screen soon. For at least a couple of years the three main focuses of 5G have been eMBB (enhanced mobile broad band), URLLC (ultra reliable low latency communications), and IIoT/IoT (industrial/internet of things). Has all the hype flowed down to your research lab, development line, or fabrication facility? Come discuss whether the III-V rubber is starting to meet the road.

Rump session C: How many VCSEL's does the world really need?

Moderator: Paul Cooke

To misquote a well-known US wireless commercial, "Can you see me now?" With the advent of facial recognition, the III-V content of high end cell phones has taken a quantum leap. 3D sensing is arguably in its infancy with many intriguing possibilities on the horizon. Combined with more traditional applications such as datacomms, are VCSEL's on the threshold of becoming the dominant III-V device technology that drives GaAs production capacity, technical insight, investment and ultimately, profit? Dare we ask, how many VCSEL's does the world really need?

Rump session D: RF GaN Reliability: Good Enough or Just OBE (Overcome By Events)?

Moderator: Dave Via

7:00 PM **SEMI STANDARDS MEETING**

Thursday, May 10th

19 2016 Intl. Conf. Compound Semicond. Manuf. Technol.

SESSION 11: TEST AND RELIABILITY

Chairs: David Meyer, *Naval Research Laboratory*
Randy Lewis, *Air Force Research Laboratory*

- 8:00 AM *Invited Presentation*
11.1 The Reliability of Compound Semiconductors, Proving It's Good Enough
William J. Roesch
Qorvo
- 8:30 AM *Invited Presentation*
11.2 Guidelines for Space Qualification of GaN HEMT
John Scarpulla
The Aerospace Corporation
- 9:00 AM *Invited Presentation*
11.3 Aspects of High Volume Test for Semiconductor Devices
James Migliaccio
Qorvo
- 9:30 AM *Student Presentation*
11.4 Gate Resistance Thermometry for GaN/Si HEMTs under RF Operation
Georges Pavlidis¹, Shamit Som², Jason Barrett², Wayne Struble², John Atherton², Samuel Graham¹
¹*Georgia Institute of Technology*, ²*MACOM*
- 9:50 AM **BREAK**

SESSION 12: MANUFACTURING

Chairs: Guoliang Zhou, *Skyworks*
Corey Nevers, *Qorvo*

- 10:20 AM *Invited Presentation*
12.1 Global Cycle Time Reduction Methodologies
Juan Velasquez, Heather Knoedler, Sergio Garcia
Skyworks Solutions
- 10:50 AM *Invited Presentation*
12.2 The Package Trend for Compound Semiconductor
Chuck Huang
WIN Semiconductors Corp.
- 11:20 AM **12.3 Operational Yield Improvements Through Application of Lean, 5S, Employee Engagement, Root Cause Investigations and Culture Change**
Peter Melnik, Daniel Sullivan, Joseph Santa,

Skyworks Solutions

- 11:40 AM *Invited Presentation*
12.4 New Product Introduction and Design for Manufacturability in GaAs IC Industry
Shiban Tiku
Skyworks Solutions
- 12:10 PM **12.5 Fabrication of 4-inch GaN/Diamond HEMT in a Compound Semiconductor Foundry**
Mo Wu¹, Won Sang Lee², Daniel Hou¹
¹*Global Communication Semiconductors, LLC*, ²*RFHIC USA*
- 12:30 PM **CS MANTECH LUNCHEON**

SESSION 13: POWER DEVICES

- Chairs: S. C. Shen, *Georgia Institute of Technology*
Eric Stewart, *Northrup-Grumman*
- 1:30 PM *Invited Presentation*
13.1 Performance and Manufacturing Perspectives of SiC T-MOS Devices
Martin Huber¹, Dethard Peters², Wolfgang Bergner¹
¹*Infineon Technologies Austria AG*, ²*Infineon Technologies AG*
- 2:00 PM *Invited Presentation*
13.2 Comparison between GaN and SiC from the Viewpoint of Vertical Power Devices
Jun Suda
Nagoya University
- 2:30 PM *Invited Presentation*
13.3 Developments of Ga₂O₃ Electronic Devices for Next-Generation Power Switching
Masataka Higashiwaki¹, Man Hoi Wong¹, Keita Konishi², Yoshiaki Nakata¹, Chia-Hung Lin¹, Takafumi Kamimura¹, Naoki Hatta³, Kuniaki Yagi³, Ken Goto⁴, Kohei Sasaki⁴, Akito Kuramata⁴, Shigenobu Yamakoshi⁴, Hisashi Murakami², Yoshinao Kumagai²
¹*National Institute of Information and Communications Technology*, ²*Tokyo University of Agriculture and Technology*, ³*SCIOCS Corporation*, ⁴*Tamura Corporation*

3:00 PM **13.4 Advances towards industrial scale epitaxial β -Ga₂O₃ and β -(Al_x, Ga_{1-x})₂O₃ for power electronics**
Ross Miller, Fikadu Alema, Andrei Osinsky
Agnitron Technology

3:20 PM **13.5 Growth of 50mm Beta-Gallium Oxide (β -Ga₂O₃) Substrates**
John Blevins
Air Force Research Laboratory

SESSION 14: POSTER

Chairs: Nick Kolarich, *II-VI EpiWorks*
 Doug Campbell, *ePak*

3:40 PM - *Student Presentation*

4:30 PM **14.1 Epitaxial Bonding and Transfer for Heterogeneous Integration of Electronic-Photonic Circuitry**
John Carlson, Patrick Su, John Dallesasse
University of Illinois at Urbana-Champaign

14.2 TaC Coated Wafer Carrier for GaN MOCVD for Blue Light-Emitting Diodes
Hao Qu¹, Brian Kozak¹, Gregory Shaffer¹,
Creighton Tomek¹, Sudarshan Natarajan¹,
Daniel Feezell², Morteza Monavarian²,
Ashwin Rishinaramangalam¹, Wei Fan¹
¹*Momentive Performance Materials*,
²*University of New Mexico*

14.3 Reactive Sputtering: TaN Process Characterization and Post PM Qualification Improvements
Jeremiah Sires
Skyworks Solutions

Student Presentation

14.4 Process Optimization and Characterization of 25 GHz Bandwidth 850 nm P-i-N Photodetector for 50 Gb/s Optical Links
Yu-Ting Peng, Dufei Wu, Ardy Winoto
University of Illinois at Urbana-Champaign

14.5 AlGa_N/Ga_N hetero-junction bipolar transistor with selective-area regrown n-type AlGa_N emitter
Lian Zhang¹, Jianping Zeng², Yun Zhang¹, Zhe Cheng¹, Hongzi Lu¹, Hongri Lv¹, Wei Tan², Junxi Wang¹
¹*Chinese Academy of Sciences*, ²*China Academy of Engineering Physics*

14.6 Development of Si-doped 8-inch GaAs substrates

Masanori Morishita¹, Hidetoshi Takayama¹,
Shuichi Kaneko¹, Hirokazu Ota¹, Tatsuya
Moriwake¹, Satoshi Horikawa², Kouji
Morishige², Yoshiaki Hagi², Yoshiki
Yabuhara²

¹*Sumiden Semiconductor Materials Co.,*

²*Sumitomo Electric Industries, Ltd*

Student Presentation

**14.7 Threshold power density reduction of
272-nm lasing from AlGaN/AlN multiple-
quantum-wells grown on nano-grating
AlN/sapphire template**

Ruxue Ni

Chinese Academy of Sciences

**14.8 High Voltage Vertical GaN p–n Diode
With N₂O Sidewall Treatment on Free-
standing GaN Wafer**

Hsien-Chin Chiu¹, Xinke Liu Liu²,

¹*Chang Gung University,* ²*Shenzhen University*

**14.9 Fabrication of True Vertical GaN
Schottky Diodes from 150 mm Engineered
Substrates**

Andrew Koehler¹, Lunet Luna¹, Marko

Tadger¹, Ozgur Aktas², Travis Anderson¹, Karl

Hobart¹, Fritz Kub¹

¹*U.S. Naval Research Laboratory,* ²*Qromis*

Inc.

**14.10 Fabrication of Hollow Structures
Using Atomic Layer Deposition**

Masayuki Nakamura¹, Takayuki Kobayashi¹,

Tatsuro Sagawa¹, Shin-ichi Motoyama¹,

Kouichirou Yuki², Ryo Inomoto², Osamu

Tsuji², Kazuyuki Tadatomo², Peter Wood¹

¹*SAMCO Inc.,* ²*Yamaguchi University*

Student Presentation

**14.11 Fabrication and Characterization of
Diamond FETs with 2D Conducting
Channels**

David Shahin¹, Kiran Kovi², Aayush Thapa¹,

Yizhou Lu¹, Ilya Ponomarev², James Butler²,

Aristos Christou¹

¹*University of Maryland,* ²*Euclid TechLabs*

**14.12 Enhancing the Manufacturability and
Evolving the Technology of GaN on SiC
Back-Side Vias**

Walter Wohlmuth, Chia-Hao Chen, Yu-Wei

Chang, Shih-Hui Huang, Fraser Wang, Benny

Ho

WIN Semiconductors Corp

Student Presentation

14.13 Design of Graded AlGa_N Channel Transistors for Improved Large-Signal Linearity

Shahadat Sohel¹, Sanyam Bajaj¹, Towhidur Razzak¹, David Meyer², Siddharth Rajan¹

¹The Ohio State University, ²Naval Research Laboratory

Student Presentation

14.14 AlGa_N/Ga_N MOS-HEMTs with Dual Field Plates for Stable High-Performance Operation

Ryota Yamaguchi, Taisei Tamazaki, Takashi Nishitani, Joel Asubar, Hirokuni Tokuda, Masaaki Kuzuhara

University of Fukui

14.15 InP/Si Fusion Wafer Bonding in Low Temperature

Xuanxiong Zhang

University of Shanghai for Science and Technology

Student Presentation

14.16 Comparison of MOCVD Grown GaSb on (001) Si Substrates Using the Aspect Ratio Trapping and Interfacial Misfit Growth Methods

Billy Lai, Qiang Li, Kei May Lau

Hong Kong University of Science and Technology

14.17 Towards Manufacturing Large Area Ga_N Substrates from QST® Seeds

Jacob Leach¹, Kevin Udway¹, Paul Quayle¹, Vladimir Odnoblyudov², Cem Basceri², Ozgur Aktas², Heather Splawn¹, Keith Evans¹

¹Kyma Technologies, ²Qromis Inc.

4:30 PM CONFERENCE CLOSING