



## North America Compound Semiconductor Materials (CSM) Technical Committee Chapter Meeting Summary and Minutes

**Teleconference & Web Meeting Only**  
Friday, November 21, 2014  
1:00 PM to 3:00 PM (U.S. Eastern Time)  
10:00 AM to 12:00 Noon (U.S. Pacific Time)

### Committee Announcements

*Next Committee Meeting*

In conjunction with CS MANTECH 2015

May 20, 2015

Hyatt Regency Scottsdale Resort & Spa at Gainey Ranch in Scottsdale, Arizona, USA

### Table 1 Meeting Attendees

*Italics indicate virtual participants*

**Co-Chairs:** James Oliver (Northrop Grumman), Russ Kremer (Freiberger)

**SEMI Staff:** Michael Tran

<i>Company</i>	<i>Last</i>	<i>First</i>	<i>Company</i>	<i>Last</i>	<i>First</i>
<i>Leighton Electronics</i>	<i>Nguyen</i>	<i>Danh</i>	<i>Northrop Grumman</i>	<i>Oliver</i>	<i>Jim</i>
<i>Leighton Electronics</i>	<i>Blew</i>	<i>Austin</i>	<i>NOVASiC</i>	<i>Kronwasser</i>	<i>Judy</i>
<i>NIST</i>	<i>Davydov</i>	<i>Albert</i>	<i>SEMI N.A.</i>	<i>Tran</i>	<i>Michael</i>

### Table 2 Leadership Changes

None

### Table 3 Ballot Results

None

### Table 4 Authorized Activities

None

### Table 5 Authorized Ballots

None

### Table 6 New Action Items

<i>Item #</i>	<i>Assigned to</i>	<i>Details</i>
2014Nov #01	Michael Tran	Gather Global SiC TF inputs for M55 5-Year Review work.
2014Nov #02	Michael Tran	Look into status of M65 5-Year Review.

**Table 7 Previous Meeting Actions Items**

<i>Item #</i>	<i>Assigned to</i>	<i>Details</i>	<i>Status</i>
2013May#02	Albert Davydov	Assist Judy Kronwasser with the flats orientation of Gallium Nitride and Sapphire in Document 4979.	Open
2013May#03	Michael Tran	Work with Judy Kronwasser on DIN standards being referenced in Document 4979.	Open
2011Sep #02	Paul Trio and Kevin Nguyen	Look into the mobility standard developed by the Japan CSM committee.	Open
2011Sep #03	Jim Oliver	Help find volunteers, possibly from Cree or II-VI, to lead the SiC Task Force.	Open

## 1 Welcome, Reminders, and Introductions

1.1 Jim Oliver, TC Chapter co-chair, called the meeting to order at 10:20 AM (U.S. Pacific Time). The meeting reminders on antitrust issues, intellectual property issues and holding meetings with international attendance were reviewed. Attendees introduced themselves.

**Attachment:** 01, Required Meeting Elements

## 2 Liaison Reports

### 2.1 Europe CSM Report

Michael Tran (SEMI) provided an update on Europe CSM activities:

- Leadership
  - Arnd Weber (SiCrystal)
  - Looking for a second cochair.
- Meetings
  - Last Meeting: October 9, 2014 (DGKK-Arbeitskreis Sitzung)
  - Next Meeting: To be confirmed, in coordination with the ERSC meeting in April, 2015
  -
- Global SiC Task Force
  - Leader: Arnd-Dietrich Weber, SiCrystal
  - Rationale: Create a basic standard for SiC wafer material and a specification for 2” ,3”, 100 mm and 150 mm SiC wafers
  - Status: 100mm wafers (Document 3784B)
    - Balloted in Cycle 05-2014
    - Approved by Technical Committee on Oct 22, 2014
  - SiC 150 mm wafer standard (Document 5370)
    - Now published online under SEMI Standard M55.3
  - Next Step: Support 5year M55 Review TF (North America), led by J. Kronwasser
- Contactless Capacitive Resistivity Measurement of SI-Semiconductors TF
  - Leader: Wolfgang Jantz, Semimap
  - Rationale: Create a standard for Capacitive Measurements (separate from NA TF addressing resistivity measurements in general; transfer and upgrading of DIN50448 )
    - Members of TF: U. Kretzer/FCM, H.-Ch. Alt/FH München
    - Invitation to: Hitachi Cable and J. Oliver/Northrop Grumman

- Ballot 5075 (Reapproval of M54, *Guide for Semi-Insulating (SI) GaAs Material Parameters*) passed
  - Reapproved SNARF/TFOF (procedural issue)
  - Ballot authorized for document: *New Standard: Contactless Resistivity Measurement of Semi-Insulating Semiconductors*
  - *New! 5-year Review TF*
    - Leader: Hans-Christian Alt, FHM
    - Rationale: Perform 5-year review of GaAs related documents:
      - SEMI M46, SEMI M63, SEMI M64
    - Documents approved for balloting - 5-year Review docs:
      - (#5733) SEMI M46: *Test Method for Measuring Carrier Concentrations in Epitaxial Layer Structures by ECV Profiling*
      - (#5732) SEMI M63: *Guideline: Test Method for Measuring the Al Fraction in AlGaAs on GaAs Substrates by High Resolution X-Ray Diffraction*
      - (#5734) SEMI M64: *Test Method for the EL2 Deep Donor Concentration in Semi-Insulating (SI) Gallium Arsenide Single Crystals by Infrared Absorption Spectroscopy*
  - Ballot Results
    - Ballot 5370: Specification for 150mm Silicon Carbide single-crystalline substrates
      - Ballot has been published under SEMI Standard M55.3
  - SEMI Staff
    - Andrea Busch | abusch@semi.org
- Action Item:** 2014Nov #01, Michael Tran to gather Global SiC TF inputs for M55 5-Year Review work.
- Attachment:** 02, Europe CSM Report

## 2.2 SEMI Staff Report

- 2014 Global Calendar of Events
  - International Technology Partners Conference [ITPC] (November 9-12, Big Island, Hawaii)
  - Collaborative Alliance for Semiconductor Test [CAST] Workshop: Implementing Next Generation Data Logging (November 12-13, San Jose, California)
  - SEMI South America Semiconductor Strategy Summit (November 18-20, Buenos Aires, Argentina)
  - SEMICON Japan (December 3-5, Tokyo)
- 2015 Global Calendar of Events
  - Industry Strategy Symposium (January 11-14, Half Moon Bay, California)
  - European 3D TSV Summit (January 19-21, Grenoble, France)
  - SEMICON Korea / LED Korea (February 4-6, Seoul)
  - Industry Strategy Symposium [ISS] Europe (February 22-24, Amsterdam, Netherlands)
  - SEMICON China / FPD China (March 17-19, Shanghai)
  - LED Taiwan (March 25-28, Taipei)
  - SEMICON Southeast Asia (April 22-24, Penang, Malaysia)
  - Advanced Semiconductor Manufacturing Conference [ASMC] (May 3-6, Saratoga Springs, New York)

- Intersolar Europe (June 10-12, Munich Germany)
- SEMICON Russia (June 17-18, Moscow)
- SEMICON West (July 14-16, San Francisco, California)
- SEMICON Taiwan (September 2-4, Taipei)
- European MEMS Summit (September 17-18, Milan, Italy)
- SEMICON Europa (October 6-8, Dresden, Germany)
- SEMICON Japan (December 16-18, Tokyo)
- NA Standards Fall 2014 Meetings (November 2-6)
  - Committees meeting at SEMI Headquarters (San Jose)
    - 3DS-IC | EHS | Facilities & Gases | HB-LED | Information & Control | Liquid Chemicals | MEMS/NEMS | Metrics | PV Materials
  - SEMI thanks Intel (Santa Clara) for hosting the Physical Interfaces & Carriers (PIC) and Silicon Wafer committees.
- SEMI Standards Publications
  - July 2014 Cycle
    - New Standards – 1, Revised Standards – 6, Reapproved Standards – 0, Withdrawn Standards – 1
  - August 2014 Cycle
    - New Standards – 2, Revised Standards – 7, Reapproved Standards – 0, Withdrawn Standards – 0
  - September 2014 Cycle
    - New Standards – 2, Revised Standards – 7, Reapproved Standards – 1, Withdrawn Standards – 1
  - October 2014 Cycle
    - New Standards – 3, Revised Standards – 9, Reapproved Standards – 1, Withdrawn Standards – 0, Total in portfolio – 917 (includes 108 Inactive Standards)
- NA Standards Spring 2015 Meetings
  - March 30 – April 2 at SEMI Headquarters (San Jose, California)
  - Inviting local companies willing and able to host some of the meetings to help maintain one-week format.
- Upcoming North America Meetings (2015)
  - NA Standards Spring 2015 Meetings (March 30 – April 2, San Jose, California)
  - NA Compound Semiconductor Materials TC Chapter Meeting (May 20 in conjunction with CS MANTECH, Scottsdale, Arizona)
  - NA Standards Meetings at SEMICON West 2015 (July 13-16, San Francisco, California)
  - NA Standards Fall 2015 Meetings (November 2-5, San Jose, California)

**Attachment:** 03, SEMI Standards Staff Report

### 3 Ballot Discussion

The committee reviewed the voting results for ballot 4979A, *New Standard: Specification for Polished Monocrystalline C-Plane Gallium Nitride Wafers*.

*Return Percentage: 60.32%*

- TC Member Returns: 38
- TC Member Distribution: 63
- Total Votes Received: 58

*Accept %: 100.00%*

- Number of Accepts: 21

*Number of Rejects: 0*

*Total Comments: 2*

Comment Issuer(s):

- Vargas-Bernal, Rafael (ITSdI)
  - “In subsections 4.1.16 and 6.4.14 different size of letter has been used.”
- Takano, Tomonobu (SOL)
  - “Is 'Maximum Defect Limit for 50.0mm wafers' correct? I guess '50.8mm' instead of '50.0mm'.”

Committee Discussion:

- The comment from Dr. Vargas-Bernal will be fixed by SEMI Publications during the final proofing process.
- The comment from Takano-san can be addressed as an editorial change since it is explicitly stated in the Scope (and other sections in the Document) that it should 50.8 mm.

The ballot will be formally adjudicated at the next NA CSM face-to-face meeting at CS MANTECH 2015 (May 20).

## 4 Liaison Reports

### 4.1 ASTM F1.15 Subcommittee

#### 4.1.1 F1.15 GaN Epitaxial Wafer Reference Material Task Force

Albert Davydov (NIST) reported for the F1.15 GaN Epitaxial Wafer Reference Material Task Force. Of note:

- New Standards
  - GaN Mobility and sheet resistivity
    - Goal to produce a replacement for Si SRM's which are unavailable.
    - GaN reference sample requirements: 1 um to 5 um thick GaN films of undoped, as well as n- and p- type doped, on highly resistive 2” to 4” diameter Si(111), c-sapphire and
      - 4H/6H-SiC substrates.
      - Note: conductive substrate can also be used providing that the insulating AlN and/or AlGaIn buffer is used.
    - Round-robin methods suggested:
      - electrical: Eddy-current; Hall; C-V;
      - optical: PL, CL, Raman;
      - microstructural: TEM, XRD

- Preliminary data on undoped GaN-on-sapphire showed reasonable correlation between NIST-measured Hall data and Dahn's Single Field measurements on LEI1610E100 machine.
- ASTM can support acquisition and distribution of materials for the round robin but not laboratories doing the testing.

Note: the efforts of this task group will be correlated with the HEMT Task Group (Mr. Danh Nguyen) in identifying industrial partners related to supplying test samples and round-robin experiments

**Attachment:** 04, F1.15 GaN Epitaxial Wafer Reference Material Task Force Update

#### 4.1.2 GaN HEMT Mobility Round Robin

Danh Nguyen (Lehighon Electronics) reported for the GaN HEMT Mobility Round Robin. Of note:

- The objective is to study various contact and non-contact methods for mobility and sheet charge/density measurement in GaN HEMT structures grown on semi-insulating SiC or Si substrates, and to study the repeatability and reproducibility of the methods.

**Attachment:** 05, GaN HEMT Mobility Round Robin Update

## 5 Subcommittee & Task Force Reports

### 5.1 Gallium Nitride (GaN) Task Force

5.1.1 Judy Kronwasser (NOVA SiC) reported for the GaN Task Force. *{See section 3 of these minutes}*

**Attachment:** 06, GaN TF Report

### 5.2 Electrical Properties Task Force

*{See section 4 of these minutes}*

## 6 Old Business

None

## 7 New Business

### 7.1 5-Year Review

Michael Tran reported that there are no documents belonging to NA CSM due for 5-Year Review. However, it was pointed out that SEMI M65 (Specifications for Sapphire Substrates to use for Compound Semiconductor Epitaxial Wafers) is due 5-Year Review which is the responsibility of the Japan CSM TC Chapter. Michael Tran will look into the status of the M65 maintenance. If the Japan CSM TC Chapter is unable to perform the maintenance, perhaps NA CSM can take on this task.

**Action Item:** 2014Nov #02, Michael Tran to look into status of M65 5-Year Review.

### 7.2 Possible New Activity related to Aluminum Nitride

Albert Davydov reported that he was looking into initiating a possible new activity on aluminum nitride. He will report further at the next committee meeting.

## 8 Action Item Review

### 8.1 Open Action Items

8.1.1 Michael Tran (SEMI N.A.) reviewed the open action items. These can be found in the Open Action Items table at the beginning of these minutes.

### 8.2 New Action Items

8.2.1 Michael Tran (SEMI N.A.) reviewed the new action items. These can be found in the New Action Items table at the beginning of these minutes.

## 9 Next Meeting and Adjournment

The next meeting of the North America Compound Semiconductor Materials committee is scheduled for Wednesday, May 20 in conjunction with the CS MANTECH conference in Scottsdale, Arizona.

Having no further business, the meeting participants mutually agreed to adjourn the North America Compound Semiconductor Materials committee teleconference meeting in November 21, 2014.

Respectfully submitted by:

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SEMI North America  
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Minutes approved by:

Jim Oliver (Northrop Grumman), Co-chair	
Russ Kremer (Freiberger), Co-chair	

**Table 8 Index of Available Attachments #1**

#	Title	#	Title
01	Required Meeting Elements	04	F1.15 GaN Epitaxial Wafer Reference Material Task Force Update
02	Europe CSM Report	05	GaN HEMT Mobility Round Robin Update
03	SEMI Staff Report	06	GaN TF Report

#1 Due to file size and delivery issues, attachments must be downloaded separately. A .zip file containing all attachments for these minutes is available at [www.semi.org](http://www.semi.org). For additional information or to obtain individual attachments, please contact Michael Tran at the contact information above.