

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

CS MANTECH 2014

Wednesday, May 21, 2014

7:00 PM to 9:00 PM (MDT)

Sheraton Denver Downtown Hotel in Denver, Colorado

Next TC Chapter Meeting

The next N.A. Compound Semiconductor Materials TC Chapter meeting will be a virtual meeting via teleconference and web meeting. Meeting date, time and details when available will be announced to the committee and posted at the SEMI Standards Calendar of Events: <http://www.semi.org/en/Standards/CalendarEvents>

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>
Freiberger	Kremer	Russ	Northrop Grumman	Oliver	Jim
Lehighton Electronics	Nguyen	Danh	NOVASiC	Kronwasser	Judy
<i>Lehighton Electronics</i>	<i>Blew</i>	<i>Austin</i>	<i>TA Francis & Associates</i>	<i>Francis</i>	<i>Terry</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

Passed ballots and line items will be submitted to the ISC Audit & Review Subcommittee for procedural review.

Failed ballots and line items were returned to the originating task forces for re-work and re-balloting.

<i>Document #</i>	<i>Document Title</i>	<i>TC Chapter Action</i>
4979	New Standard: Specification for Polished Monocrystalline C-Plane Gallium Nitride Wafers	Failed and returned to the TF for rework
5593	Line Item Revision to SEMI M9.7-0708, Specification for Round 150 mm Diameter Polished Monocrystalline Gallium Arsenide Wafers (Notched)	
Line Item 1	Addition of Thickness, center point of 550 um to §4, Physical Requirements	Passed as balloted. Superclean.

Table 4 Authorized Activities

There were no authorized activities.

Table 5 Authorized Ballots

<i>#</i>	<i>When</i>	<i>SC/TF/WG</i>	<i>Details</i>
4979A	Cycle 5 or 6-2014	Gallium Nitride (GaN) TF	New Standard: Specification for Polished Monocrystalline Gallium Nitride Wafers

Table 6 New Action Items

<i>Item #</i>	<i>Assigned to</i>	<i>Details</i>
2014May#01	Albert Davydov	To find 2-3 people at NIST to help perform the Hall measurements.
2014May#02	Michael Tran	To coordinate the next Fall 2014 virtual meeting for the N.A. CSM TC Chapter.

Table 7 Previous Meeting Actions Items

<i>Item #</i>	<i>Assigned to</i>	<i>Details</i>	<i>Status</i>
2013May#01	Albert Davydov	Send Judy Kronwasser the number for the melting point at atmosphere pressure for Document 4979 (Specification for Gallium Nitride).	CLOSED
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.	Still open.
2011Sep #03	Jim Oliver	Help find volunteers, possibly from Cree or II-VI, to lead the SiC Task Force.	In progress.

1 Welcome, Reminders, and Introductions

1.1 Jim Oliver and Russ Kremer, TC Chapter co-chairs, called the meeting to order at 7:38 PM (MDT). 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 Review of Previous Meeting Minutes

2.1 The committee reviewed the previous meeting minutes from the Fall 2012 Virtual Meeting and CS MANTECH 2013.

Motion: To approve the previous meeting minutes Fall 2012 Virtual Meeting and CS MANTECH 2013 as written.

By / 2nd: Russ Kremer (Freiberger) / Danh Nguyen (Lehightronics)

Discussion: None.

Vote: Unanimous in favor. Motion passed.

Attachment: 02, N.A. CSM (CS MANTECH 2013) Meeting Minutes

Attachment: 03, N.A. CSM Virtual Meeting Minutes (Fall 2013)

3 Liaison Reports

3.1 ASTM F1.15 Subcommittee

3.1.1 F1.15 GaN Epitaxial Wafer Reference Material Task Force

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

- Goal: Develop test methods for evaluating transport properties of GaN epi-layers
 - The TF was able to obtain wafer samples from Ostendo (formerly TDI, Inc.) and Kyma

- Samples from Ostendo are GaN on Sapphire, 2 inch and includes one unintentionally doped n-type and one Si doped
- Sample from Kyma is GaN on Sapphire, 3 inch and is unintentionally doped n-type
- Electrical hall testing was performed on the wafer samples obtained
 - Results of the electrical hall testing on the sample from Kyma will be used in the follow-up GaN round robin measurements
 - The sample wafers will then be shipped to Danh Nguyen
- The TF will carry on with its testing of non-destructive and destructive methods for electrical, optical and microstructural on the samples obtained
 - electrical: Eddy-current; Hall; C-V, CTLM;
 - optical: PL, CL, Raman;
 - microstructural: TEM, XRD

Action Item: 2014May#01, Albert Davydov to find 2-3 people at NIST to help perform the Hall measurements.

Attachment: 04, ASTM F1.15 - GaN Update (CS MANTECH 2014)

3.1.2 GaN HEMT Mobility Round Robin

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

- GaN HEMT Mobility Round Robin [Update]
 - First round: non-destructive, non-contact testing
 - The schedule to test the GaN samples grown on SiC, Silicon and Sapphire substrates was planned from May to August 2014
 - Each company participating in the testing had two weeks to test the samples and ship it back to Lehighon Electronics
 - Participants include:
 - Northrop Grumman, Raytheon, IQE, BAE Systems, and others
 - Lehighon Electronics performed incoming samples inspection prior to shipping the samples to the next participant
 - Lehighon Electronics will work with ASTM Staff for data analysis and writing the test reports
 - The test results for the first round will be reported at the next NA CSM Meeting

Attachment: 05, GaN HEMT Mobility Round Robin Update (CS MANTECH 2014)

3.2 Europe Compound Semiconductor Materials TC Chapter

3.2.1 Michael Tran (SEMI N.A.) gave the Europe Compound Semiconductor Materials TC Chapter report. The key items were as follows:

- The committee chair is Arnd Weber (SiCrystal)

- Meetings
 - Last meeting was in Nürnberg, Germany, 10th April, 2014
 - Next meeting to be October 2014, in conjunction with SEMICON Europa
- Global SiC TF
 - Document 3784E (100 mm SiC Wafers) approved for balloting in Cycle 4, 2014
 - Document 5370 (150 mm SiC Wafers) is pending publication
- Contactless Capacitive Resistivity Measurement of SI-Semiconductors TF
 - Document 5075 (Reapproval of SEMI M54 S.I. GaAs Material Parameters) passed as balloted
- 5 Year Review TF
 - The TF is performing 5 year review for the following documents:
 - SEMI M46-1101E (Reapproved 0309) - *Test Method for Measuring Carrier Concentrations in Epitaxial Layer Structures by ECV Profiling*
 - SEMI M63-0306 - *Guideline: Test Method for Measuring the Al Fraction in AlGaAs on GaAs Substrates by High Resolution X-Ray Diffraction*
 - SEMI M64-0306 - *Test Method for the EL2 Deep Donor Concentration in Semi-Insulating (SI) Gallium Arsenide Single Crystals by Infrared Absorption Spectroscopy*
- SEMI EU Contact, Andrea Busch (abusch@semi.org)

Attachment: 06, EU CSM TC Chapter Report (CS MANTECH 2014)

3.3 *Japan Compound Semiconductor Materials TC Chapter*

3.3.1 There was no report received.

3.4 *N.A. SEMI Standards Staff Report*

3.4.1 Michael Tran (SEMI N.A.) gave the N.A. SEMI Standards Staff Report. The key items were as follows:

- 2014 Global Calendar of Events
 - European 3D TSV Summit (January 21-22, Grenoble, France)
 - SEMICON Korea / LED Korea (February 12-14, Seoul)
 - SEMICON China (March 18-20, Shanghai)
 - SEMICON Singapore (April 23-25, Marina Bay Sands)
 - SEMICON Russia (May 14-15, Moscow)
 - SEMI Advanced Semiconductor Manufacturing Conference [ASMC] (May 19-21, Saratoga Springs, New York)
 - SEMICON West (July 8-10, San Francisco, California)
 - SEMICON Taiwan (September 3-5, Taipei)
 - SEMICON Europa / Plastic Electronics (October 7-9, Grenoble, France)
 - SEMICON Japan (December 3-5, Tokyo)
- NA Standards Spring 2014 Meetings (March 31 – April 3)

- Committees meeting at SEMI Headquarters (San Jose)
 - 3DS-IC | EHS | Facilities & Gases | Information & Control | Metrics | PV Materials
- SEMI thanks Intel (Santa Clara) for hosting the PIC and Silicon Wafer meetings
- Upcoming North America Meetings (2014)
 - NA Standards Meetings at SEMICON West 2014 (July 7- 10, San Francisco, California)
 - NA Standards Fall 2014 Meetings (November 3-6, San Jose, California)
- Standards Publications Report
 - November 2013 Cycle
 - New Standards – 1, Revised Standards – 6, Reapproved Standards – 3, Withdrawn Standards – 0
 - December 2013 Cycle
 - New Standards – 2, Revised Standards – 11, Reapproved Standards – 4, Withdrawn Standards – 0
 - January 2014 Cycle
 - New Standards – 3, Revised Standards – 3, Reapproved Standards – 0, Withdrawn Standards – 1
 - February 2014 Cycle
 - New Standards – 4, Revised Standards – 5, Reapproved Standards – 0, Withdrawn Standards – 1
 - Total in portfolio – 901 (includes 99 Inactive Standards)
- Official SEMI Standards Groups
 - LinkedIn
 - <http://www.linkedin.com/groups/Official-SEMI-Standards-Group-1774298/about>
 - Twitter
 - @SEMI_standard
- SEMI N.A. Standards staff contact: Michael Tran, mtran@semi.org

Attachment: 07, SEMI N.A. Standards Staff Report (CS MANTECH 2014)

4 Ballot Review

NOTE 1: TC Chapter adjudication on the ballots are detailed in the Audits & Reviews (A&R) Subcommittee Forms for procedural review. These A&R forms are available as attachments to these minutes. The attachment number for each ballot document is provided under each ballot review below.

<i>Document #</i>	<i>Document Title</i>	<i>TC Chapter Action</i>
4979	New Standard: Specification for Polished Monocrystalline C-Plane Gallium Nitride Wafers	Failed and returned to the TF for rework
5593	Line Item Revision to SEMI M9.7-0708, Specification for Round 150 mm Diameter Polished Monocrystalline Gallium Arsenide Wafers (Notched)	
Line Item 1	Addition of Thickness, center point of 550 um to §4, Physical Requirements	Passed as balloted. Superclean.

Motion: Document 4979 failed TC Chapter review and will be returned to the TF for rework.
By / 2nd: Judy Kronwasser (NOVASiC) / Russ Kremer (Freiberger)
Discussion: None.
Vote: Unanimous in favor. Motion passed.

Attachment: 08, Ballot Review Summary for Doc. 4979

Motion: Document 5593, Line item 1 passed TC Chapter review as balloted and will be forwarded to the A&R subcommittee for procedural review.
By / 2nd: Russ Kremer (Freiberger) / Danh Nguyen (Lehighon Electronics)
Discussion: None.
Vote: Unanimous in favor. Motion passed.

Attachment: 09, A&R Procedural Review Form for Doc. 5593

5 Subcommittee & Task Force Reports

5.1 Gallium Nitride (GaN) Task Force

5.1.1 Judy Kronwasser (NOVASiC) reported for the GaN Task Force. Of note:

- Update on Document 4979, (Polished Monocrystalline GaN Wafers)
 - The document failed because the TF agreed with the reject votes to revise the specifications in Appendix 1 from Freiberger and others (see §4 of these minutes for TC Chapter review details).
 - The document will be reballoted in Cycle 5 or 6-2014 as Document 4979A
 - It will be adjudicated at the next NA CSM meeting during CS MANTECH 2015

Attachment: 10, GaN TF Report (CS MANTECH 2014)

5.2 Electrical Properties Task Force

5.2.1 Austin Blew (Lehighon Electronics) reported for the Electrical Properties Task Force. There was no update from the TF. The TF deferred to ASTM F1.15 Subcommittee (see § 3.1 of these minutes).

5.3 SEMI M55 (Specification for Polished Monocrystalline Silicon Carbide Wafers) Task Force

5.3.1 Judy Kronwasser (NOVASiC) reported for the M55 Task Force. The TF will await further word regarding the IP review of SEMI M55 from Arnd Weber.

5.4 N.A. Silicon Carbide (SiC) Task Force

5.4.1 Michael Tran (SEMI N.A.) reported for the N.A. SiC Task Force. Of note:

- The TF is still looking for a TF leader
- The TF deferred to the EU Silicon Carbide TF where most of the SiC activities have taken place:
 - The EU Silicon Carbide TF reviewed Intellectual Property (IP) for the 100 mm SiC wafers and 100 mm SiC wafers documents

- Document 5370 (150 mm SiC Wafer Specification) is pending publication
- Document 3784E (100 mm SiC Wafer Specification) will be balloted in Cycle 4, 2014 and to be adjudicated at the next EU CSM Meeting during SEMICON Europa 2014

Attachment: 11, EU SiC TF Report (CS MANTECH 2014)

6 Old Business

6.1 Five-Year Review

6.1.1 There were no CSM documents from N.A. that were due for five year reviews except for SEMI 9.7 which Document 5593 was passed as balloted by the N.A. CSM TC Chapter (see §4 of these minutes for TC Chapter review details).

7 New Business

7.1 Upcoming Ballots

#	When	SC/TF/WG	Details
4979A	Cycle 5 or 6-2014	Gallium Nitride (GaN) TF	New Standard: Specification for Polished Monocrystalline Gallium Nitride Wafers.

Motion: To approve the letter balloting of Document 4979A in Cycle 5 or 6-2014.

By / 2nd: Russ Kremer (Freiberger) / Danh Nguyen (Lehightron Electronics)

Discussion: None.

Vote: Unanimous in favor. Motion passed.

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

9.1 The next N.A. Compound Semiconductor Materials TC Chapter meeting will be a virtual meeting via teleconference and web meeting. Meeting date, time and details when available will be announced to the committee and posted at the SEMI Standards Calendar of Events: <http://www.semi.org/en/Standards/CalendarEvents>

9.2 Having no further business, the meeting participants mutually agreed to adjourn the N.A. Compound Semiconductor Materials committee meeting in conjunction with CS MANTECH 2014 on May 21, 2014 in Denver, Colorado.

Action Item: 2014May#02, Michael Tran to coordinate the next Fall 2014 virtual meeting for the N.A. CSM TC Chapter.

Respectfully submitted by:

Michael Tran
 Senior Standards Engineer
 SEMI North America
 Phone: 1-408-943-7019
 Email: mtran@semi.org

Minutes approved by:

Jim Oliver (Northrop Grumman), Co-chair	October 03, 2014
Russ Kremer (Freiberger), Co-chair	October 03, 2014

Table 8 Index of Available Attachments #1

#	<i>Title</i>	#	<i>Title</i>
01	Required Meeting Elements	07	SEMI N.A. Standards Staff Report (CS MANTECH 2014)
02	N.A. CSM (CS MANTECH 2013) Meeting Minutes	08	Ballot Review Summary for Doc. 4979
03	N.A. CSM Virtual Meeting Minutes (Fall 2013)	09	A&R Procedural Review Form for Doc. 5593
04	ASTM F1.15 - GaN Update (CS MANTECH 2014)	10	GaN TF Report (CS MANTECH 2014)
05	GaN HEMT Mobility Round Robin Update (CS MANTECH 2014)	11	EU SiC TF Report (CS MANTECH 2014)
06	EU CSM TC Chapter Report (CS MANTECH 2014)		

#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. For additional information or to obtain individual attachments, please contact Michael Tran at the contact information above.