North America HB-LED TC Chapter
Meeting Summary and Minutes

N.A. Standards HB-LED Meetings
Tuesday, February 25, 2014 13:00 – 17:00 PST
SEMI Headquarters in San Jose, California

Next Committee Meeting
The next NA Standards HB-LED Meetings will be held in conjunction with the NA Standards meetings at SEMICON West 2014 at the San Francisco Marriott Marquis Hotel in San Francisco, California. Exact meeting dates and details as they become available will be posted here: http://www.semi.org/en/node/49446

Table 1 Meeting Attendees

Co-Chairs:
Iain Black (Philips Lumileds)
Mike Feng (Silian)
Bill Quinn (William Quinn Consulting)
Chris Moore (BayTech-Resor)

SEMI Staff: Michael Tran

Company	*Last*	*First*	*Company*	*Last*	*First*
BayTech Group	Baylies	Winthrop	Silian	Zhang	Preston
BW & Associates	Wu	Bevan	Silian	Feng	Mike
Canon USA	Suzuki	Tadashi	*SMS*	*Poduje*	*Noel*
Materials & Metrology	Bullis	Murray	Sonoscan	Martell	Steve
MKS Instruments	*Radjabi*	*Bahman*	SuperSight	Peroots	Len
Philips Lumileds	Black	Iain	Veeco	Kraus	Joe
PrimeNano	Amster	Oskar	Ventura Precision	Houston	Fred
Resor Associates	Resor	Griff			
Rubicon Technology	*Ciraldo*	*John*			
Saint-Gobain	*Maiocco*	*Lisa*	SEMI N.A.	Tran	Michael
Self	*Wagner*	*Peter*	SEMI N.A.	Trio	Paul

Italics indicates virtual participants

Table 2 Leadership Changes

Group	*Previous Leader*	*New Leader*
NA HB-LED Committee, co-chair	David Reid (Silian)	Mike Feng (Silian) *pending NARSC approval*
HB-LED Wafer TF	Julie Chao (Silian) David Joyce (GT Advanced Technologies)	Win Baylies (BayTech Group)
HB-LED Impurities and Defects TF	Julie Chao (Silian) David Joyce (GT Advanced Technologies)	
Patterned Sapphire Substrate (PSS) TF	Matt Novak (Bruker) Nigel Mason (Laytec AG)	Win Baylies (BayTech Group)

Table 3 Ballot Results

Document #	*Document Title*	*Committee Action*
5684	Line Item Revisions to SEMI HB1-0113, Specifications for Sapphire Wafers Intended for Use for Manufacturing High Brightness-Light Emitting Diode Devices	
Line Item 1	Revisions and Changes in Light Blue Highlight	Passed committee review. Superclean.
Line Item 2	Revisions and Changes in Light Green Highlight	Passed committee review.
Line Item 3	Revisions and Changes in Light Yellow Highlight	Passed committee review.

Table 4 Authorized Activities

#	*Type*	*SC/TF/WG*	*Details*
5630	Withdrawal of SNARF	HB-LED Wafer TF	New Standard, Guide for Measuring Surface Roughness of Sapphire Wafers for HB-LED Applications

Note: SNARFs and TFOFs are available for review on the SEMI Web site at:
http://downloads.semi.org/web/wstdsbal.nsf/TFOFSNARF

Table 5 Authorized Ballots

None.

Table 6 New Action Items

Item #	*Assigned to*	*Details*
2014Feb#01	Mike Feng	To work on the Double Sided Polished (DSP) Wafer table for SEMI HB1.
2014Feb#02	Mike Feng & Len Peroots	Prepare a white paper on DSP wafers at the next NA HB-LED TC Chapter meeting.
2014Feb#03	Win Baylies, Oskar Amster, Lisa Maiocco, & Steve Martell	To form a working group and help with identifying and supplying sapphire wafer defect pictures.
2014Feb#04	Iain Black	Contact Jule Flemish for work on a Patterned Sapphire Substrate (PSS) guide.
2014Feb#05	Win Baylies	To follow up with Dr. Donggren Ko from Rubicon to resume PSS discussion.
2014Feb#06	Noel Poduje	Report on a bow standard in the AWG TF applicable to Sapphire wafers at the next NA HB-LED TC Chapter
2014Feb#07	Peter Wagner	Prepare a TFOF to form a HB-LED Test Methods TF and SNARF for a new test method document.

Table 7 Previous Meeting Actions Items

Item #	*Assigned to*	*Details*	*Status*
2013Oct#01	HB-LED Wafer TF	Meeting on November 13 to review ballot proposal of Document 5684.	CLOSED

Item #	*Assigned to*	*Details*	*Status*
2013Oct#02	HB-LED Wafer TF	Write supporting paragraph to explain changes to roughness description in SEMI HB1.	CLOSED.
2013Oct#03	Impurities and Defects TF	Collect images for area contamination, particles, and voids.	Open
2013Oct#04	Impurities and Defects TF	Include scale for all images.	Open
2013Oct#05	Impurities and Defects TF	Review Page 1 (Purpose, Scope, Limitations, Referenced Standards and Documents) in SEMI HB1.	Open
2013Oct#06	Impurities and Defects TF	Meet on November 12 to review updated document. Need to determine which Cycle in 2014 to ballot Document 5629.	Open
2013Jul#01	Michael Tran	Forward Brian Rubow's ballot motion slides to David Reid (Silian).	CLOSED. David Reid no longer in the Program.
2013Jul#02	Michael Tran	Work with Natalie Shim (SEMI Korea) to align the Korea HB-LED Working Group charter with the Global HB-LED charter.	Open
2013Jul#03	Michael Tran	Transfer existing SNARFs under the Equipment TF	Open
2013Jul#04	Bevan Wu	Re-instigate communication with ITRI on 2" PSS feedback.	Open
2013Jul#05	Peter Wagner	Share wafer flatness parameter presentation.	Has to be published in M1 first as RI to reference it.
2013Jul#07	Peter Wagner, Julie Chao, Win Baylies, Jhon Stover, Steve Martell, and Christopher Jones	To work on the first draft of Document # 5630, (Guide for Measuring Surface Roughness of Sapphire Wafers for HB-LED Applications) by October 2013.	CLOSED. SNARF 5630 is withdrawn. See §7.2 for details.
2013Apr#02	David Joyce	Work on the defect definitions as a Related Information addition to SEMI HB1.	CLOSED. David Joyce no longer in the Program.
2013Apr#06	Win Baylies, Julie Chao, Francis Nguyen	Review SEMI M38 and work on adding reclaimed wafer specifications to SEMI HB1.	CLOSED. Julie Chao no longer in the Program.
2013Apr#010	Len Perroots	Prepare a report to the committee on the applicability of notchless wafers to HB-LED sapphire wafers.	Follow up with Len.
2012Oct#02	Chris Moore	Review SNARF #5529 (HB-LED JMMM) for Aixtron only specifications.	OPEN
2012Oct#03	Chris Moore	Send an email to the European Silicon Wafer committee regarding the HB-LED committee revisions to their SNARF for Gallium Nitride on Silicon Wafer	OPEN

1 Welcome, Reminders, and Introductions

1.1 Win Baylies (BayTech Group) called the meeting to order. The meeting reminders on antitrust issues, intellectual property issues and holding meetings with international attendance were reviewed. Attendees introduced themselves.

Attachment: 01, SEMI Standards Required Meeting Elements

2 Review of Previous Meeting Minutes

2.1 The committee did not review the minutes of the previous meeting from Fall 2013. It will be reviewed at the next NA HB-LED TC Chapter meeting at SEMICON West 2014.

3 Liaison Reports

3.1 *N.A. SEMI Staff Report*

3.1.1 Michael Tran (SEMI N.A.) gave the N.A. 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 Compound Semiconductor Materials in conjunction with CS MANTECH 2014 (May 21, Denver, Colorado)
  - 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)
- SEMI N.A. Standards staff contact: Michael Tran, mtran@semi.org

Attachment: 02, SEMI NA Standards Staff Report (Spring 2014)

3.2 *Korea HB-LED Working Group*

3.2.1 Michael Tran (SEMI NA) reported for the Korea HB-LED Working Group. Some key items of note:

- Leadership
    - Hyungsu Park / SEMES
    - Jonghyup Baek/ KOPTI
- Meeting Information
    - Last meeting
        - February 13, 2014 at Coex, Seoul, Korea
    - Next Meeting
        - Tentatively in May, August or November 2014
- Major Updates
    - MO (Molybdenum) Source team
        - The General MO Source specifications were submitted by WG members
        - The team listed intersection items and the list was reviewed by chemical companies
        - The SNARF draft will be submitted in the next meeting
    - SEMI HB1 Review team
        - As a result of 4 revision candidates, the team selected below 3 items. SNARF draft will be submitted in the next meeting in May.
            - Flat length
            - r plane direction
            - Flatted wafer flat zone spec
- SEMI Korea Standards staff contact: Natalie Shim, eshim@semi.org

Attachment: 03, Korea HB-LED Working Group Report (February 2014)

4 Ballot Review

NOTE 1: Committee adjudication on ballots is 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 balloted document is provided under each committee review motion below.

Document #	Document Title	Committee Action
5684	Line Item Revisions to SEMI HB1-0113, Specifications for Sapphire Wafers Intended for Use for Manufacturing High Brightness-Light Emitting Diode Devices	
Line Item 1	Revisions and Changes in Light Blue Highlight	Passed committee review. Superclean.
Line Item 2	Revisions and Changes in Light Green Highlight	Passed committee review.
Line Item 3	Revisions and Changes in Light Yellow Highlight	Passed committee review.

Motion: Line Items 1, 2, and 3 of Document 5684 passed committee review as balloted and will be forwarded to the A&R for procedural review.

By / 2nd: Len Peroots (SuperSight) / Griff Resor (Resor Associates)

Discussion: None.

Vote: 9-0 in favor. Motion passed.

Attachment: 04, Procedural Review for Document #5684

5 Subcommittee & Task Force Reports

5.1 *HB-LED Wafer Task Force / Impurities and Defects Task Force*

5.1.1 Winthrop Baylies (BayTech Group) and others reported for the HB-LED Wafer Task Force / Impurities and Defects Task Force. The TF discussed the following topics:

- *SEMI HB1 Discussion*
  - Reviewed Document # 5684, *Line Item Revisions to SEMI HB1-0113, Specifications for Sapphire Wafers Intended for Use for Manufacturing High Brightness-Light Emitting Diode Devices*
    - Discussed the interpretation of the Bow Tolerance
      - No changes to the Bow Tolerance
  - Planning to add DSP Sapphire Wafer Specifications to SEMI HB1 and other revisions

- *HB-LED Wafer Marking Experiment Project Discussion*
  - Background
    - Several mark fields, each containing a Data Matrix (SEMI T7) and Alpha-Numeric (SEMI M12) message, will be marked on these wafers with surface finish as specified for the back surface. Because the front- and back-surfaces of the starting wafers have identical surface conditions, after marking, the mark field locations distinguish front- from back-surfaces. This marking uses mark field characteristics that are widely deployed in silicon wafer production.
  - Participants
    - Silian - Sapphire wafer maker
    - InnoLas - Lasermark equipment maker
    - HTT - Lasermark equipment reader maker

    - Osram - HB-LED device maker
  - Completed actions
    - Silian - Sliced and lasermarked both sides of wafer
    - InnoLas - Completed laser marking the 2 wafers
  - Next steps
    - Silian - Polish wafers by March 2014
    - HTT - Pre-Epi characterization by April 2014
    - Osram - Perform epi growth by April 2014
    - Lasermark characterization post-epi by May 2014

- *Impurities and Defects Discussion:*
  - SNARF #5630 (Measuring Surface Roughness of Sapphire Wafers)
    - The SNARF was withdrawn due to SEMI M40 (*Measurement of Roughness of Planar Surfaces on Silicon Wafers*) covering most of the information (see §7.2 for details).
  - Doc. 5629 (Identification of Features on Surface of Sapphire Wafers)
    - The sapphire wafer defects survey list was sent to companies in late 2013
    - Company responses from the list will be incorporated into the document
    - Currently discussing defects captured from Silian and Altatech
    - Issues include:
      - There are difficulties with the defect geometry description and terminology
      - There are too many types and variations of defects
      - The tools used to measure and identify defects may vary across companies leading to different results
      - Proposed including the most general defects into the document and update if needed

- *Double Sided Polished (DSP) Wafers Discussion*
  - Reviewed proposed specifications for 2”, 4” and 6” DSP wafers
    - DSP wafers specifications will be added to SEMI HB1 (Specifications for Sapphire Wafers for Manufacturing HB-LED Devices) after further review

- *Patterned Sapphire Substrates (PSS) Specifications Discussion*
  - The TF reviewed PSS properties such edge exclusion and PSS technology from Rubicon. See attachments #08 and #09 for details.
- *Other Discussion*
  - Sapphire Wafer Stress Parameters to SEMI HB1
    - Thinning substrates to reduce stress

- Improve LED Wavelength Uniformity
- Improve LED Wavelength Accuracy
- Requires use of a specific equipment

– Sapphire Tablet Substrates
  - Used in Smart Phone applications such as touch screen, camera lens covers, buttons and etc.
  - Drafting potential survey to gauge interest from device makers and suppliers in the industry
  - Sapphire Tablet Substrates Issues
    - Physical Dimensions
    - Optical Characteristics
    - Edge Properties

Action Item: 2014Feb#01, Mike Feng to work on the Double Sided Polished (DSP) Wafer table for SEMI HB1.

Action Item: 2014Feb#02, Mike Feng & Len Peroots to prepare a white paper on DSP wafers at the next NA HB-LED TC Chapter meeting.

Action Item: 2014Feb#03, Win Baylies, Oskar Amster, Lisa Maiocco, & Steve Martell to form a working group and help with identifying and supplying sapphire wafer defect pictures.

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Action Item: 2014Feb#05, Win Baylies to follow up with Dr. Donggren Ko from Rubicon to resume PSS discussion.

Action Item: 2014Feb#06, Noel Poduje to report on a bow standard in the AWG TF applicable to Sapphire wafers at the next NA HB-LED TC Chapter.

Action Item: 2014Feb#07, Peter Wagner to prepare a TFOF to form a HB-LED Test Methods TF and SNARF for a new test method document.

Attachment: 05, Sapphire DSP Wafer Specification Proposal (February 2014)

Attachment: 06, Wafer Marking Experiment Update (February 2014)

Attachment: 07, Wafer Stress Management (February 2014)

Attachment: 08, PSS Edge Exclusion (February 2014)

Attachment: 09, PSS Brochure from Rubicon (February 2014)

Attachment: 10, Tablet Substrates (February 2014)

5.2 *Patterned Sapphire Substrates (PSS)Task Force*

5.2.1 Win Baylies (BayTech Group) reported for the TF. Please see § 5.1, HB-LED Wafer Task Force / Impurities and Defects Task Force for PSS discussion.

5.3 *HB-LED Equipment Communication Interfaces TF*

5.3.1 There was no report given.

6 Old Business

6.1 None.

7 New Business

7.1 *New Co-chair of the NA HB-LED TC Chapter*

7.1.1 The NA HB-LED TC Chapter nominated and approved Mike Feng (Silian) to replace David Reid (Silian) as the new co-chair of the chapter.

Motion: To approve Mike Feng (Silian) as the new NA HB-LED TC Chapter co-chair.
By / 2nd: Oskar Amster (PrimeNano) / Griff Resor (Resor Associates)
Discussion: None.
Vote: 8-0 in favor. Motion passed.

7.2 *Withdrawal of SNARF*

#	*Type*	*SC/TF/WG*	*Details*
5630	Withdraw SNARF	HB-LED Wafer TF	New Standard, Guide for Measuring Surface Roughness of Sapphire Wafers for HB-LED Applications

Motion: To withdraw SNARF #5630
By / 2nd: Oskar Amster (PrimeNano) / Griff Resor (Resor Associates)
Discussion: SEMI M40 (Measurement of Roughness of Planar Surfaces on Silicon Wafers) covering most of the information in this SNARF already.
Vote: 6-0 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 NA Standards HB-LED Meetings will be held in conjunction with the NA Standards meetings at SEMICON West 2014 at the San Francisco Marriott Marquis Hotel in San Francisco, California. Exact meeting dates and details as they become available will be posted here: http://www.semi.org/en/node/49446

Tentative Schedule

Wednesday, July 9*

· Patterned Sapphire Substrate (PSS) TF (08:30 AM - 12:00 PM Noon)

Thursday, July 10*

· HB-LED Equipment Communication Interfaces TF (09:00 AM - 2:30 PM)
· HB-LED Wafer TF / Impurities & Defects TF (08:00 AM - 3:00 PM)
· HB-LED Technical Committee (3:00 PM - 5:00 PM)

9.2 Having no further business, a motion was made to adjourn the N.A. HB-LED committee meeting on February 25, 2014 in conjunction with the N.A. Standards HB-LED Meetings at SEMI Headquarters in San Jose, California.

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

Minutes approved by:

Chris Moore (BayTech Resor), Co-chair	
Bill Quinn (William Quinn Consulting), Co-chair	
Mike Feng (Silian), Co-chair	
Iain Black (Philips Lumileds), Co-chair	

Table 8 Index of Available Attachments [#1]

#	*Title*	#	*Title*
01	SEMI Standards Required Meeting Elements	06	Wafer Marking Experiment Update (February 2014)
02	SEMI NA Staff Report (February 2014)	07	Wafer Stress Management (February 2014)
03	Korea HB-LED Working Group Report (February 2014)	08	PSS Edge Exclusion (February 2014)
04	Procedural Review for Document #5684	09	PSS Rubicon Brochure
05	Sapphire DSP Wafer Specification Proposal (February 2014)	10	Tablet Substrates (February 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.