North America HB-LED Technical Committee Chapter
Meeting Summary and Minutes

North America Standards Spring 2015 Meetings
02 April 2015, 1330 – 1630 Pacific Time
SEMI Headquarters in San Jose, California

Committee Announcements

Next Committee Meeting
NA Standards Meetings at SEMICON West 2015
Thursday, July 16, 2015; 1330 – 1630 Pacific Time
San Francisco Marriott Marquis Hotel in San Francisco, California

Table 1 Meeting Attendees
*Italics* indicate virtual participants

| Co-Chairs: | Iain Black (Philips), Mike Feng (Silian), Chris Moore (BayTech-Resor) |
| SEMI Staff: | Michael Tran |

<table>
<thead>
<tr>
<th>Company</th>
<th>Last</th>
<th>First</th>
<th>Company</th>
<th>Last</th>
<th>First</th>
</tr>
</thead>
<tbody>
<tr>
<td>BayTech-Resor</td>
<td>Baylies</td>
<td>Win</td>
<td>Sonoscan</td>
<td>Martell</td>
<td>Steve</td>
</tr>
<tr>
<td>BW &amp; Associates</td>
<td>Wu</td>
<td>Bevan</td>
<td>Veeco</td>
<td>Armour</td>
<td>Eric</td>
</tr>
<tr>
<td>Consultant</td>
<td>Wagner</td>
<td>Peter</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rubicon Technology</td>
<td>Ciraldo</td>
<td>John</td>
<td>SEMI</td>
<td>Tran</td>
<td>Michael</td>
</tr>
</tbody>
</table>

Table 2 Leadership Changes

<table>
<thead>
<tr>
<th>Group</th>
<th>Previous Leader</th>
<th>New Leader</th>
</tr>
</thead>
<tbody>
<tr>
<td>Display Materials and Metrology Working Group</td>
<td>Win Baylies (BayTech-Resor)</td>
<td></td>
</tr>
<tr>
<td>NA HB-LED Tablet Working Group</td>
<td>(Disbanded)</td>
<td></td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>Document #</th>
<th>Document Title</th>
<th>Committee Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>5748</td>
<td>New Standard: Test Method for Measurement of Thickness and Shape of Crystalline Sapphire Wafers Using Optical Probes</td>
<td>Passed TC Chapter review with editorial changes.</td>
</tr>
</tbody>
</table>
Table 4 Authorized Activities

<table>
<thead>
<tr>
<th>#</th>
<th>Type</th>
<th>SC/TF/WG</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>#</th>
<th>When</th>
<th>SC/TF/WG</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 6 New Action Items

<table>
<thead>
<tr>
<th>Item #</th>
<th>Assigned to</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015Apr #01</td>
<td>Peter Wagner</td>
<td>Peter Wagner to prepare Doc. 5748 follow-up ballot after A&amp;R approval.</td>
</tr>
<tr>
<td>2015Apr #02</td>
<td>John Ciraldo</td>
<td>Identify Rubicon contact to participate in PSS activity.</td>
</tr>
</tbody>
</table>

Table 7 Previous Meeting Actions Items

<table>
<thead>
<tr>
<th>Item #</th>
<th>Assigned to</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014Nov #03</td>
<td>Chris Moore, Michael Tran</td>
<td>Have a session at the next TF or TC Chapter meeting on the cleanup and chopping block of inactive Task Forces under the NA HB-LED TC Chapter.</td>
</tr>
<tr>
<td>2013Oct #03</td>
<td>Impurities and Defects TF</td>
<td>Collect images for area contamination, particles, and voids.</td>
</tr>
<tr>
<td>2013Oct #04</td>
<td>Impurities and Defects TF</td>
<td>Include scale for all images.</td>
</tr>
<tr>
<td>2013Oct #05</td>
<td>Impurities and Defects TF</td>
<td>Review Page 1 (Purpose, Scope, Limitations, Referenced Standards and Documents) in SEMI HB1.</td>
</tr>
<tr>
<td>2013Jul #02</td>
<td>Michael Tran</td>
<td>Work with Natalie Shim (SEMI Korea) to align the Korea HB-LED Working Group charter with the Global HB-LED charter.</td>
</tr>
<tr>
<td>2013Jul #03</td>
<td>Michael Tran</td>
<td>Transfer existing SNARFs under the Equipment TF</td>
</tr>
<tr>
<td>2013Jul #04</td>
<td>Bevan Wu</td>
<td>Re-instigate communication with ITRI on 2” PSS feedback.</td>
</tr>
</tbody>
</table>

1 Welcome, Reminders, and Introductions

Win Baylies, acting committee co-chair, called the meeting to order at 1:30 PM. After welcoming all attendees, a round of introductions followed. The SEMI meeting reminders on membership requirements, antitrust, patentable technology, and meeting guidelines were then presented and explained.

Attachment: 01, SEMI Standards Required Meeting Elements

2 Review of Previous Meeting Minutes

The committee reviewed the minutes of the previous meeting held November 6 in conjunction with the NA Standards Fall 2014 meetings.

Motion: Accept the minutes of the previous meeting as written.

By / 2nd: Peter Wagner (Self) / Steve Martell (Sonoscan)

Discussion: None
Vote: 4-0 in favor. Motion passed.

Attachment: 02, NA HB-LED Fall 2014 meeting (November 6) minutes

3 Liaison Reports

3.1 Korea HB-LED Chapter Formation Group (CFG)

The key items were as follows:

- Meeting Information
  - Last meeting: March 12, 2015 at SEMI Korea Office (Seoul)
  - Next meeting: TBD

- Major Updates
  - 5818 (HB1 Revision)
    - Requesting Cycle 4 ballot approval to NA HB-LED TC chapter
  - MO Source activity
    - KOR HB-LED CFG prepared the responses to NA HB-LED technical committee’s feedback. The SNARF approval request will be made with the final feedback from NA HB-LED technical committee.

- HB-LED Source Material TF
  - Charter
    - To establish standards for the source materials used in HB-LED epitaxial growth processes.
  - Scope
    - Generating new standard for source materials (MO sources and Hydride Gases) for MOCVD growth process to produce HB-LED.
    - Maintain and update existing HB-LED process related standards
    - Continue to search and validate new source materials used in MOCVD production to be standardized.
  - TF Leaders
    - Paul Ahn (Veeco), H.B.Joo (Aixtron), Sungjin Jun (LG Innotek), Deok-gil Ko (Samsung Electronics)

Responses to the NA HB-LED technical committee:

- MO sources in the Scope section be split individually. Start with the first source and then proceed with the rest one at a time.
  - Does the NA HB-LED TC chapter suggest to create 5 different SNARFs to separate listed sources? To get clearer picture, further explanation might needed.

<table>
<thead>
<tr>
<th>NA HB-LED TC Chapter Discussion/Response:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes, one SNARF per source.</td>
</tr>
<tr>
<td>Eric Armour and Peter Wagner both commented that it is easier to write a document for each compound rather than bundling them together. Similarly, Win Baylies pointed out that it would be easier addressing a material issue per SNARF rather than bundling them together.</td>
</tr>
<tr>
<td>The new standard could also talk about handling, how it's packaged, and the initial bubble preparation</td>
</tr>
<tr>
<td>The Korea HB-LED CFG will consider it as a future item when we have proper member to cover that scope.</td>
</tr>
</tbody>
</table>

- The new standard could also talk about handling, how it's packaged, and the initial bubble preparation
  - The Korea HB-LED CFG will consider it as a future item when we have proper member to cover that scope.
NA HB-LED TC Chapter Discussion/Response:

- Peter Wagner commented that the standard might be rejected if it does not address handling, how it’s packaged, and the initial bubble preparation. He urged the group to consider these items.

- MO sources canisters have double male connections. Also each chemical supplier have different size canisters. It would be good have a standard addressing these topics.
  - The Korea HB-LED CFG will consider it as a future item when we have proper member to cover that scope.
- The SEMI Standards Program also have a Gases committee. Your new standard could be under the HB-LED or the Gases committee. Have you looked into the Gases committee for potential support?
  - Korea CFG wants to be linked with HB-LED TC and will issue intercommittee ballot to GAS TC when it needs.
- Staff Contact: Natalie Shim (eshim@semi.org)

Attachment: 03, Korea HB-LED Liaison Report

3.2 China HB-LED Committee

The key items were as follows:

- Meeting Information
  - Last meeting: China Standards Spring Meeting 2015
    - Friday, April 10th, 2015 (Nanjing, Jiangsu; China)
  - Next meeting: China Standards Fall Meeting 2015
    - Friday, Sept. 18th, 2015 (Huangshan, Anhui; China)

- Single Crystal Sapphire Task Force
  - Charter:
    - Draft the standards on specifications for single crystal sapphire intended for use for manufacturing HB-LED wafers.
  - Working on:

- Sapphire Single Crystal Ingot Task Force
  - Charter:
    - Define the key parameters of LED sapphire ingot, including dimension, orientation of the end face and flat, surface quality, bulk defects, etc.
    - Formulate the inspection methods of the key parameters for LED sapphire ingot.
    - Formulate and establish inspection standards of the key parameters for LED sapphire ingot.
  - Working on:

- GaN based LED Epitaxial Wafer Task Force
  - Charter:
    - This Task Force is chartered to develop test methods and specifications for GaN based HB-LED epitaxial wafer in order to increase the production efficiency.
  - Working on:
Doc. 5776, New Standard: Test Method for Detecting Surface Defects of GaN based LED Epitaxial Wafer Used for Manufacturing HB-LED

- Staff Contact: Kris Shen (kshen@semi.org)

**Attachment:** 04, China HB-LED Liaison Report

3.3 **SEMI Staff Report**

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

- 2015 Global Calendar of Events
  - 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)
  - Strategic Materials Conference [SMC] (September 22-23, Mountain View, California)
  - SEMICON Europa (October 6-8, Dresden, Germany)
  - SEMICON Japan (December 16-18, Tokyo)

- NA Standards Spring 2015 Meetings (March 29 to April 2)
  - 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) committee and task force meetings.
  - SEMI thanks KLA-Tencor (Milpitas) for hosting the Silicon Wafer committee and task force meetings.

- Upcoming North America Meetings (2015)
  - 2015:
    - 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)
  - 2016:
    - NA Standards Spring 2016 Meetings (April 4-7, San Jose, California)

- Technical Ballot Critical Dates for NA Standards meetings at SEMICON West 2015
  - Cycle 4: due April 10 / Voting Period: April 21 – May 21
  - Cycle 5: due May 8 / Voting Period: May 22 – June 22
Standards Publications Report

<table>
<thead>
<tr>
<th>Cycle</th>
<th>New</th>
<th>Revised</th>
<th>Reapproved</th>
<th>Withdrawn</th>
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<tbody>
<tr>
<td>November 2014</td>
<td>1</td>
<td>4</td>
<td>1</td>
<td>0</td>
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<tr>
<td>December 2014</td>
<td>3</td>
<td>4</td>
<td>3</td>
<td>0</td>
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<tr>
<td>January 2015</td>
<td>5</td>
<td>2</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>February 2015</td>
<td>3</td>
<td>7</td>
<td>3</td>
<td>0</td>
</tr>
</tbody>
</table>

- Total in portfolio – 928 (includes 110 Inactive Standards)

New Requirements/Process Reminders for TC Chapter Meetings

- Standards Document Development Project Period
  - Project period shall not exceed 3 years (Regs 8.3.2)
    - SNARF approval to TC Chapter approval
    - If document development activity is found to be continuing, but cannot completed with the project period, TC Chapter may grant one-year extension at a time, as many times as necessary.

- SNARF Review Period
  - A submitted SNARF for a new, or for a major revision to an existing, Standard or Safety Guideline is made available to all members of a TC Chapter’s parent global technical committee for two weeks for their review and comment. (Regs 8.2.1)
    - If the SNARF is submitted at a TC Chapter meeting, the committee can review and approve, but the SNARF will need to be distributed for two weeks and then approved via GCS.

- New SNARF & TFOF forms [embedded in Staff Report, see Attachment 03 of these minutes]

- Procedures for Correcting Nonconforming Titles of Published Standards Document (PM Appendix 4)
  - Some Standards qualify for a special procedure where a line item change can be used to correct the titles. Otherwise, the corrective action will likely require a major revision.

- Table of Content (TOC)
  - No section of a Standard or Safety Guideline may contain a list of section numbers and titles (e.g., similar to a Table of Contents).
  - Table of content can be approved editorially during Reapproval

- Assignment of Draft Document Numbers
  - Upon successful publication of a Document, or termination of work on it by the TF, Standards staff retires the Document number and its associated SNARF, and they are not to be used for further Document development activity.
  - For a Document with Line Item(s) that passed while others failed, the same SNARF may be used to reballot only those failed Line Item(s).
  - A new SNARF is required to introduce new Line Item(s).

- SNARF
  - SNARFs may be submitted and approved for new, revised, reapproved, or reinstated Documents that have been approved by the TC Chapter, but not yet published (i.e., no new Publication Date Code exists yet). (PM NOTE 8)

- Minority Report (MR)
  - The motion passes if a simple majority of the total GCS voting membership (i.e., not just those who return votes) approve the motion (Regs 9.9)
• Latest Approvals/Next Revisions
  o Follow-up revisions of Regulations and Procedure Manual were published on 27 March, 2015 for use in NA Spring Standard meetings.

• Regulations/PM Ballot Revisions

<table>
<thead>
<tr>
<th>Group #</th>
<th>Title</th>
<th>Regs</th>
<th>PM</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Clarification on Standards Document Development Project Period</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>2</td>
<td>GCS Voting Period for Minority Reports</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>3</td>
<td>Improvement on Minority Report Handling for Shorter Time to Publication</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>4</td>
<td>TC Membership Requirement</td>
<td>Y</td>
<td>N</td>
</tr>
<tr>
<td>5</td>
<td>Ballot Adjudication Process Improvement</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>6</td>
<td>Revision to Procedural Review</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>7</td>
<td>Clarification of TC Chapter Review and Adjudication Term</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>8</td>
<td>Clarification of Procedure Guide to Procedure Manual</td>
<td>Y</td>
<td>Y</td>
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<tr>
<td>9</td>
<td>Miscellaneous Changes of Regulations</td>
<td>Y</td>
<td>N</td>
</tr>
<tr>
<td>10</td>
<td>Add New Requirements Related to Notices</td>
<td>N</td>
<td>Y</td>
</tr>
<tr>
<td>11</td>
<td>Add New Guidance Related to Note</td>
<td>N</td>
<td>Y</td>
</tr>
<tr>
<td>12</td>
<td>Clarification on SNARF and TFOF submitter</td>
<td>N</td>
<td>Y</td>
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<tr>
<td>13</td>
<td>Clarification on SNARF approval procedures for New Standards/Safety Guidelines and major revision of existing Standards/Safety Guidelines</td>
<td>N</td>
<td>Y</td>
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<td>14</td>
<td>Update Appendix 4 Related to Correction of Nonconforming Titles</td>
<td>N</td>
<td>Y</td>
</tr>
<tr>
<td>15</td>
<td>Clarifications of Procedures Related to Table of Contents</td>
<td>N</td>
<td>Y</td>
</tr>
<tr>
<td>16</td>
<td>Clarifications on Use of Shall, Must, and Should</td>
<td>N</td>
<td>Y</td>
</tr>
<tr>
<td>17</td>
<td>Miscellaneous Changes to Procedure Manual</td>
<td>N</td>
<td>Y</td>
</tr>
</tbody>
</table>

Indicates follow-up from Oct-Nov 2014 Regs ballot

• Ballot Adjudication Process Improvement (Group 5)
  o Problem
    ▪ Publications of Documents can be delayed by the need to go through another cycle of Letter Ballot issuance and adjudication at a TC Chapter meeting to make any technical change.
  o Proposed Solution
    ▪ Allow TC Chapter to make technical changes on balloted Standard Document during its adjudication under certain conditions. Conduct a Ratification Ballot in order to ensure global consensus on supporting the technical changes made by the TC Chapter.
  o NOTE: This Group was originally proposed as Group 10 in the previous Regulations Ballot to ISC and failed.
    ▪ Taking suggestion of ISC at its SEMICON Japan 2014 meeting in December, the scope of the Ratification Ballot is now limited to technical changes made by TC Chapter during adjudication of a Letter Ballot.
• GCS Voting Period for Minority Report (Group 2)
  o Problem
    ▪ Voting period for Minority Report is too short to solicit sufficient votes from GCS voting members.
  o Proposed Solution
    ▪ To let GCS member have 2 weeks voting period, which is same length as the Minority Report submission window.
  o NOTE: This problem was raised by the NARSC at its Fall 2014 meeting at which the ISC Ballot on Regulations change was discussed. Following-up on this problem by additional changes in the Regulations was suggested by the Regulations SC Chair at the time.

• Improvement on Minority Report Handling for Shorter Time to Publication (Group 3)
  o Problem
    ▪ Despite the rare occurrence of MR submission, every Document approved by the TC Chapter has to wait at least a month before it qualifies for A&R procedural review, which in turn results in a longer time to publish.
  o Proposed Solution
    ▪ Expedite the process by allowing A&R procedural review to be commenced as soon as record of ballot review made available.
    ▪ If an MR is submitted on a Document, Publication will be on hold until responsible parties reach conclusion on the MR. If the Document is returned to the TF for rework based on consideration of the MR, A&R approval is nullified.
  o NOTE: This problem was raised by JARSC at its SEMICON Japan 2014 meeting. ISC members expressed their support on improvement toward faster publication.

Attachment: 05, SEMI Standards Staff Report
4 Ballot Review

**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.

NOTE 1: Committee adjudication on Cycles 1, 2015 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 document is provided below the summary tables.

4.1 Cycle 1, 2015 Ballot

<table>
<thead>
<tr>
<th>Document #</th>
<th>Document Title</th>
<th>Committee Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>5747</td>
<td>New Standard: Test Method for Measurement of Saw Marks on Crystalline Sapphire Wafers Using Optical Probes</td>
<td><strong>Passed</strong> TC Chapter review with editorial changes.</td>
</tr>
<tr>
<td>5748</td>
<td>New Standard: Test Method for Measurement of Thickness and Shape of Crystalline Sapphire Wafers Using Optical Probes</td>
<td><strong>Passed</strong> TC Chapter review with editorial changes.</td>
</tr>
<tr>
<td>5749</td>
<td>New Standard: Test Method for Measurement of Waviness of Crystalline Sapphire Wafers Using Optical Probes</td>
<td><strong>Passed</strong> TC Chapter review with editorial changes.</td>
</tr>
</tbody>
</table>

**Action Item:** 2015Apr#01, Peter Wagner to prepare Doc. 5748 follow-up ballot after A&R approval.

**Attachment:**
- 06, Ballot Review for Doc. 5747
- 07, Ballot Review for Doc. 5748
- 08, Ballot Review for Doc. 5749

5 Task Force Reports

5.1 HB-LED Wafer Task Force

The key items were as follows:

- **Sapphire Wafer Marking Experiment**
  - **Goal**
    - Determine Effects of Mark Depth on Mark Readability and Survivability
    - Target Mark Depths: 30, 35, 40, 45 and 50 um
    - Start 2012
    - Complete ~ 1 year
  - **Labs**
    - Silian – sapphire wafers
      - polish1, polish2 (post-grind)
    - Innolas – Marking
    - HTT – Mark Reading
    - Osram – MOCVD Process, Mark Reading
  - **Status (03/31/2015)**
    - Silian – Final Wafer Finishing OPEN
    - HTT – Reading TBD
    - Osram – Epi, Reading TBD
    - Final Report TBD

**Attachment:**
- 09, HB-LED Summary of Activities (Sapphire Wafer Marking Experiment)
5.2 HB-LED Impurities & Defects Task Force

The key items were as follows:

- Defects
  - Selected Sapphire Defect Types
    - Have Photos & Brief Description ~10 types
    - Goal: Illustrated Glossary ~ MF154 Guide for Identification of Structures and Contaminants Seen on Specular Silicon Surfaces
  - Need
    - More examples & WG members
    - Geographically-separated key interests

- Sapphire Impurities
  - Expertise needed
  - Understanding of Impurities’
    - Effects on sapphire capabilities
    - Inspection / Measurement
  - Holistic Approach

Attachment: 10, HB-LED Summary of Activities (HB-LED Impurities & Defects)

5.3 Patterned Sapphire Substrates (PSS) Task Force

The key items were as follows [see attachment for detailed images]:

- PSS Wafers (3 shapes – 2 views)
- Basic PSS Pattern Parameters (pitch, height, width)
- PSS Examples
  - Shape (cone, dome, pyramid [square base])
  - Pattern Density (3 µm / 2 µm / 1.5 µm pitch)
  - Geometry (cone or dome, square pyramid)
  - Hexagon Orientation (with respect to flat or notch)

Action Item: 2015Apr#02, John Ciraldo to identify Rubicon contact to participate in PSS activity.

Attachment: 11, HB-LED Summary of Activities (Patterned Sapphire Substrates)

5.4 Tablet Working Group

The key items were as follows:

- Goals
  - Compare effects on Supply Chain
    - Smart Phone Ubiquity
    - Flat Panel Display
      - Larger
      - Smarter
      - Fewer
    - TFT / OLED competition
• Progress
  o 2015 Tablet Demand
    ▪ Significant growth 2011-2014
    ▪ Fcst 11.8% drop 2015 [Digitimes]
      • Consumer Tablets slowing
      • Larger Smartphones, mkt squeezing demand
    ▪ BUT FPD Area Demand Growing
      • 2014 = +9%
      • CAGR = +5% from 2012
      • 223.6 Million Sq. Meters in 2020 [IHS]
  • [Tablet Shipments] [see attachment for details]
  • [FPD Demand Area Growth] [see attachment for details]
  • [New TV – LCD/OLED (Resolution, Battery Life)] [see attachment for details]
• Mobile PC Brands
  o Introducing larger screens
    ▪ Convertible form factors
    ▪ 10” → 12.9” [2015]
  o LCD TV
  o Smartphone
  o Automotive
    ▪ Full dashboard digitalization
    ▪ Central info display
    ▪ Advanced Driver Assist Systems
• Conclusions
  o Mixed Metaphors
    ▪ “Tablet”
    ▪ “Smart Phone”
    ▪ “Screen”
    ▪ “TV”
  o IoT
    ▪ Massive Digitalization
    ▪ Small, embedded devices
    ▪ Huge quantities
    ▪ Social Effects, Opportunities, Challenges
• Display Materials and Metrology Working Group
  o Scope
    ▪ Standards for Materials and test methods used in active and passive displays
    ▪ Examples include
      • Touchscreen and Touchpad
      • Display screens (TV, watch, smartphone, automotive, tablet, etc.)
    ▪ Examples excluded
      • Covers (cameras, watches, etc.)
      • Non-electronics interfaces
Motion: Approve formation of HB-LED Display Materials and Metrology Working Group
By / 2nd: Steve Martell (Sonoscan) / Bevan Wu (BW & Associates)
Discussion: None
Vote: 4-0 in favor. Motion passed.

Motion: Disband HB-LED Table Working Group
By / 2nd: John Ciraldo (Rubicon Technology) / Bevan Wu (BW & Associates)
Discussion: None
Vote: 3-0 in favor. Motion passed.

Attachment: 12, HB-LED Summary of Activities (Tablet WG / Display Materials and Metrology WG)

6 Old Business

6.1 Status update on action items generated from the previous meetings:

<table>
<thead>
<tr>
<th>Item #</th>
<th>Assigned to</th>
<th>Details</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014Nov#01</td>
<td>Eric Armour</td>
<td>To share with Veeco Korea his feedback for a proposed new standard: Specification of Epitaxial Metal Organic Sources and copy Michael Tran.</td>
<td>Closed.</td>
</tr>
<tr>
<td>2014Nov#02</td>
<td>Win Baylies / Chris Moore / Michael Tran</td>
<td>Let the Korea HB-LED Working group members know about the revisions made to their TFOFs and SNARFs at the NA HB-LED TC Chapter meeting.</td>
<td>Closed.</td>
</tr>
<tr>
<td>2014Nov#03</td>
<td>Chris Moore / Michael Tran</td>
<td>To have a session at the next TF or TC Chapter meeting on the cleanup and chopping block of inactive Task Forces under the NA HB-LED TC Chapter.</td>
<td>Open.</td>
</tr>
<tr>
<td>2014Nov#04</td>
<td>Michael Tran</td>
<td>To let Michael Tran know that Chris Moore is now the primary co-chair representing the NA HB-LED TC Chapter to the NARSC.</td>
<td>Closed.</td>
</tr>
<tr>
<td>2013Oct #03</td>
<td>Impurities and Defects TF</td>
<td>Collect images for area contamination, particles, and voids.</td>
<td>Open.</td>
</tr>
<tr>
<td>2013Oct #04</td>
<td>Impurities and Defects TF</td>
<td>Include scale for all images.</td>
<td>Open.</td>
</tr>
<tr>
<td>2013Oct #05</td>
<td>Impurities and Defects TF</td>
<td>Review Page 1 (Purpose, Scope, Limitations, Referenced Standards and Documents) in SEMI HB1.</td>
<td>Open.</td>
</tr>
<tr>
<td>2013Jul #02</td>
<td>Michael Tran</td>
<td>Work with Natalie Shim (SEMI Korea) to align the Korea HB-LED Working Group charter with the Global HB-LED charter.</td>
<td>Open.</td>
</tr>
<tr>
<td>2013Jul #03</td>
<td>Michael Tran</td>
<td>Transfer existing SNARFs under the Equipment TF</td>
<td>Open.</td>
</tr>
<tr>
<td>2013Jul #04</td>
<td>Bevan Wu</td>
<td>Re-instigate communication with ITRI on 2” PSS feedback.</td>
<td>Open.</td>
</tr>
</tbody>
</table>

7 Action Item Review

7.1 Open Action Items

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

7.2 New Action Items

Michael Tran (SEMI) reviewed the new action items. These can be found in the New Action Items table at the beginning of these minutes.
8 Adjournment
The next NA HB-LED TC Chapter meeting is scheduled for July 16 in conjunction with SEMICON West 2015 in San Francisco, California. The tentative schedule is provided below:

SEMICON West 2015 Meetings
July 13-16, 2015
San Francisco Marriott Marquis Hotel
780 Mission Street
San Francisco, California 94103
U.S.A.

Tuesday, July 14 or Wednesday, July 15
- (Tentative) Impurities & Defects / PSS Workshop (Time: TBD)

Thursday, July 16
- HB-LED Wafer TF / Impurities & Defects TF (09:00 AM to 11:00 AM)
- Displays and Metrology WG (11:00 AM to 12:00 PM)
- NA HB-LED Technical Committee Chapter (1:30 PM to 4:30 PM)

Having no further business, a motion was made to adjourn the NA HB-LED TC Chapter meeting on April 2 in conjunction with the NA Standards Spring 2015 Meetings. Adjournment was at 2:00 PM.

Respectfully submitted by:
Michael Tran
Senior Standards Engineer
SEMI North America
Phone: +1.408.943.7019
Email: mtran@semi.org

Minutes approved by:

<table>
<thead>
<tr>
<th>Name</th>
<th>Company</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iain Black</td>
<td>Philips</td>
</tr>
<tr>
<td>Mike Feng</td>
<td>Silian</td>
</tr>
<tr>
<td>Chris Moore</td>
<td>BayTech-Resor</td>
</tr>
<tr>
<td>Eric Armour</td>
<td>Veeco</td>
</tr>
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</table>

June 17, 2015
<table>
<thead>
<tr>
<th>#</th>
<th>Title</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>SEMI Standards Required Meeting Elements</td>
</tr>
<tr>
<td>2</td>
<td>NA HB-LED Fall 2014 (November 6) meeting minutes</td>
</tr>
<tr>
<td>3</td>
<td>Korea HB-LED CFG Liaison Report</td>
</tr>
<tr>
<td>4</td>
<td>China HB-LED Liaison Report</td>
</tr>
<tr>
<td>5</td>
<td>SEMI Standards Staff Report</td>
</tr>
<tr>
<td>6</td>
<td>Ballot Review for Doc. 5747</td>
</tr>
<tr>
<td>7</td>
<td>Ballot Review for Doc. 5748</td>
</tr>
<tr>
<td>8</td>
<td>Ballot Review for Doc. 5749</td>
</tr>
<tr>
<td>9-12</td>
<td>HB-LED Summary of Activities (Sapphire Wafer Marking Experiment)</td>
</tr>
<tr>
<td></td>
<td>HB-LED Summary of Activities (HB-LED Impurities &amp; Defects)</td>
</tr>
<tr>
<td></td>
<td>HB-LED Summary of Activities (Patterned Sapphire Substrates)</td>
</tr>
<tr>
<td></td>
<td>HB-LED Summary of Activities (Tablet WG / Display Materials and Metrology WG)</td>
</tr>
</tbody>
</table>

#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.