Next Committee Meeting

SEMI Staff
Kevin Nguyen – SEMI HQ

Co-chair – Lori Nye (Brewer Science)

Table 1 – Meeting Attendees

<table>
<thead>
<tr>
<th>Last Name</th>
<th>First Name</th>
<th>Company</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baylies</td>
<td>Win</td>
<td>BayTech-Resor</td>
</tr>
<tr>
<td>Gotts</td>
<td>Hugh</td>
<td>Air Liquide Electronics US</td>
</tr>
<tr>
<td>Martell</td>
<td>Steve</td>
<td>Sonoscan</td>
</tr>
<tr>
<td>Wagner</td>
<td>Peter</td>
<td>Self</td>
</tr>
</tbody>
</table>

Table 2 – Organization/Task Force Changes
None

Table 3 – Ballots Summary

<table>
<thead>
<tr>
<th>Document #</th>
<th>Document Title</th>
<th>Committee Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>5802</td>
<td>New Standard: Test Method for In-Line Measurement of Saw Marks on PV Silicon Wafers by Laser Position Sensor</td>
<td>Failed and returned to TF</td>
</tr>
<tr>
<td>5803</td>
<td>New Standard: Test Method for In-Line, Noncontact Measurement of Thickness and Thickness Variation of Silicon Wafers for PV Applications Using Laser Triangulation Sensors</td>
<td>Failed and returned to TF</td>
</tr>
</tbody>
</table>

Table 4 – Authorized Ballots

<table>
<thead>
<tr>
<th>#</th>
<th>When</th>
<th>SC/TF/WG</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>5860</td>
<td>Cycle 4/5</td>
<td>Int'l PV Analytical Test Methods, Metrology, and Inspection TF</td>
<td>Line Item of SEMI PV11-1110 Specifications For Hydrofluoric Acid, Used In Photovoltaic Applications</td>
</tr>
<tr>
<td>5861</td>
<td>Cycle 4/5</td>
<td>Int'l PV Analytical Test Methods, Metrology, and Inspection TF</td>
<td>Line Item Revision of SEMI PV12-1110 Specifications For Phosphoric Acid Used In Photovoltaic Applications</td>
</tr>
<tr>
<td>5862</td>
<td>Cycle 4/5</td>
<td>Int'l PV Analytical Test Methods, Metrology, and Inspection TF</td>
<td>Reapproval of SEMI PV3-0310 Guide For High Purity Water Used In Photovoltaic Cell Processing</td>
</tr>
<tr>
<td>5863</td>
<td>Cycle 4/5</td>
<td>Int'l PV Analytical Test Methods, Metrology, and Inspection TF</td>
<td>Reapproval of SEMI PV5-1110 Guide For Oxygen (O2), Bulk, Used In Photovoltaic Applications</td>
</tr>
<tr>
<td>5864</td>
<td>Cycle 4/5</td>
<td>Int'l PV Analytical Test Methods, Metrology, and Inspection TF</td>
<td>Reapproval of SEMI PV6-1110 Guide For Argon (Ar), Bulk, Used In Photovoltaic Applications</td>
</tr>
</tbody>
</table>
Table 5 – Authorized Activities

<table>
<thead>
<tr>
<th>#</th>
<th>Type</th>
<th>SC/TF/WG Details</th>
<th>Details</th>
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<tr>
<td>5860</td>
<td>SNARF</td>
<td>Int'l PV Analytical Test Methods, Metrology, and Inspection TF</td>
<td>Line Item of SEMI PV11-1110 Specifications For Hydrofluoric Acid, Used In Photovoltaic Applications</td>
</tr>
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</tr>
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<td>5864</td>
<td>SNARF</td>
<td>Int'l PV Analytical Test Methods, Metrology, and Inspection TF</td>
<td>Reapproval of SEMI PV6-1110 Guide For Argon (Ar), Bulk, Used In Photovoltaic Applications</td>
</tr>
<tr>
<td>5865</td>
<td>SNARF</td>
<td>Int'l PV Analytical Test Methods, Metrology, and Inspection TF</td>
<td>Reapproval of SEMI PV7-1110 Guide For Hydrogen (H2), Bulk, Used In Photovoltaic Applications</td>
</tr>
<tr>
<td>5866</td>
<td>SNARF</td>
<td>Int'l PV Analytical Test Methods, Metrology, and Inspection TF</td>
<td>Reapproval of SEMI PV8-1110 Guide For Nitrogen (N2), Bulk, Used In Photovoltaic Applications</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 6 – Previous Meeting Actions Items

<table>
<thead>
<tr>
<th>Item #</th>
<th>Assigned to</th>
<th>Details</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>0714-4</td>
<td>Hugh Gotts</td>
<td>To conduct 5 year review of SEMI PV3 Guide for High Purity Water Used in Photovoltaic Cell Processing, and report at the next meeting</td>
<td>Completed</td>
</tr>
<tr>
<td>1114-1</td>
<td>Hugh Gotts</td>
<td>To forward these standards to his colleague for review.</td>
<td>Completed</td>
</tr>
</tbody>
</table>
  - SEMI PV5-1110 Guide for Oxygen (O2), Bulk, Used in Photovoltaic Applications
  - SEMI PV6-1110 Guide for Argon (Ar), Bulk, Used in Photovoltaic Applications
  - SEMI PV7-1110 Guide for Hydrogen (H2), Bulk, Used in Photovoltaic Applications
  - SEMI PV8-1110 Guide for Nitrogen (N2), Bulk, Used in Photovoltaic Applications
  - SEMI PV11-1110 Specifications for Hydrofluoric Acid, Used in Photovoltaic Applications
  - SEMI PV12-1110 Specifications for Phosphoric Acid Used in Photovoltaic Applications

Table 7 – New Actions Items

<table>
<thead>
<tr>
<th>Item #</th>
<th>Assigned to</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>0415-1</td>
<td>Kevin Nguyen (SEMI Staff)</td>
<td>To inform Kris Shen to review activities in the Power Station Equipment Integrated Performance Task Force with leaders in China and recommend to disband due to out of alignment with PV Committee and SEMI’s scope.</td>
</tr>
<tr>
<td>0415-2</td>
<td>Hugh Gotts (Air Liquide)</td>
<td>To contact Evans Analytical Group to provide round robins data for the Inert Gas Fusion Infrared Detection Method and Carbon Concentration by SIMS Method</td>
</tr>
</tbody>
</table>
1.0 Call to Order
Lori Nye called the meeting to order and welcomed everyone who attended. A round of self-introduction was made. All SEMI standards meetings are subjected to SEMI Anti-Trust Reminder and Guidelines concerning Patentable Technology. SEMI Regulations now require all attendees to be members of SEMI standards. Membership enrollment is at www.semi.org/standardsmembership. The agenda was reviewed and approved.

2.0 Review and Approval of Meeting Minutes from NA Fall Standards Meeting, San Jose, CA, November 5, 2014
Minutes were reviewed. No change was made.

Motion: To accept the minutes as written.
By / 2-: Hugh Gotts/Peter Wagner
Discussion: None
Vote: Unanimous. Motion passed

Attachment – 1, NAPVMaterialsMeetingMinutes20141105

3.0 Staff Report
Report was given by Kevin Nguyen. Highlights.
• Intersolar Visitor Registration
  o Complimentary Expo Only badge is opened from April 1-May 8
  o Register Today!
    ▪ http://www.semiconwest.org/Participate/RegisterNow
• There are now 9 ballots cycle for 2015
  o http://www.semi.org/en/Standards/P_000788
• SEMI Standards Publications
  o Total SEMI Standards in portfolio: 928
• New Requirements/Process Reminders for TC Chapter Meetings from December 2014 Regulations
  o Standards Document Development Project Period
    ▪ Project period shall not exceed 3 years (Regs 8.3.2)
    ▪ 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.
  o 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.
  o New SNARF & TFOF Form

Attachment – 2, SEMI Staff Report (Spring 2015) rev2
Attachment – 3, Regs_SC_to_NARSC2015_0329_rev1.0

4.0 Liaison Reports

4.1 European PV Materials Committee
Report was given by Kevin. Highlights.
• Last meeting
  o Oct 7, 2013
  o SEMICON Europa
  o Dresden, Germany
• Next meeting

NA PV/PV Materials TC Chapters Meeting Minutes

April 1, 2015
San Jose, CA
Ballot Results Summary from October meeting

- Doc 5565, Line Item Revision to PV42, Test Method for In-Line Measurement of Waviness on PV Silicon Wafers by a Light Sectioning Technique Using Multiple Line Segments – PASSED
- Doc 5433, New Standard, Test Method for In-line Characterization of PV Silicon Wafers regarding Grain Size – PASSED and PUBLISHED as PV52-0214
- Doc 5432, New Standard, Test Method for In-line Characterization of PV Silicon Wafers by Using Photoluminescence – PASSED and PUBLISHED as PV51-0214

PV Silicon Materials TF

- Published Standards
  - PV17-1012 Specification for Virgin Silicon Feedstock Materials for Photovoltaic Applications
  - PV39-0912 Test Method for In-Line Measurement of Cracks in PV Silicon Wafers by Dark Field Infrared Imaging
  - PV40-0912 Test Method for In-Line Measurement of Saw Marks on PV Silicon Wafers by a Light Sectioning Technique Using Multiple Line Segments
  - PV41-0912 Test Method for In-Line, Noncontact Measurement of Thickness and Thickness Variation of Silicon Wafers for PV Applications Using Capacitive Probes
  - PV42-0113 Test Method for In-Line Measurement of Waviness of PV Silicon Wafers by a Light Sectioning Technique Using Multiple Line Segments

- Discussion of plan for round robin regarding SEMI PV40, 41, 42, 46 developed by P.W.

A workshop on Round Robin was conducted at the Intersolar Europe meeting in June 2014.

- Themes dealt with:
  - Detection of PID
  - Inspect 1200 kWp in 24 h with Electroluminescence
  - Advanced EL Module Inspection: From Counting (Micro)Cracks to the Prediction of Upcoming Power Loss
  - Advanced Inspection Technology for Solar Cell and Module Production and Influence of Product Lifetime
  - Metrology for Solar Cell Screening to Minimize Panel Degradation
  - Microstructural Characterization of Defects in Solar Modules
  - PV Chain – Quality Assurance for the Solar Industry

SEMI Europe Staff

- Andrea Busch (abusch@semi.org)

Attachment – 4, 141022_Europe_PVMat_LiaisonReport

4.2 Japan PV/PV Materials Committee

Report was given by Kevin Nguyen. Highlights

- Last Meeting
  - December 10, 2014 at SEMI Japan Office, Tokyo, Japan

- Next Meeting
  - TBD

- Japan PV Materials TF
    - Passed and published as PV 60-0115

- Reorganization
  - Japan TC Chapters of PV Global TC and PV Materials Global TC have been jointly discussing the reorganization.

- SEMI Japan Staff (Chie Yanagisawa, cyanagisawa@semi.org)

Attachment – 5, 150401_JA_PV&PV&M_PVMNA_Spring-2015_R0.1
4.3 Taiwan PV Committee

Highlights. Report given by Kevin.

- Last meeting
  - March 26, 2015
  - ITRI

- Next meeting
  - June 25, 2015
  - ITRI

- Ballots approved and passed TC Review
  - Draft #: 5431 New Standard: Test Method for Performance Criteria of Photovoltaic (PV) Cell and Module Package, Published as PV56-1214
  - Draft #: 5597 New Standard: Test Method for Current-Voltage (I-V) Performance Measurement of Organic Photovoltaic (OPV) and Dye-Sensitized Solar Cell (DSSC), Published as PV57-1214

- Drafting documents.
  - SEMI Doc. 5647, Test Method for SR Measurement of Organic Photovoltaic (OPV) and Dye-Sensitized Solar Cell (DSSC)
  - SEMI Doc. 5560 - Classification of BIPV – Part 1: Classification of BIPV Module Dimension
  - SEMI Doc. 5598 - Test Method for Durability of Low Light Intensity Organic Photovoltaic (OPV) and Dye Sensitized Solar Cell (DSSC)
  - SEMI Doc. 5739 - Test Method to Evaluate an Accelerated Thermo Humidity Resistance of PV Encapsulants
  - SEMI Doc. 5740 - Test Method of Electrochemical Corrosion for PV Module

- Regional Staff Contact Information.
  - Andy Tuan (attuan@semi.org)

Attachment – 6, Taiwan PV Liaison Report Mar 2015

4.4 China PV Committee

Kevin reported. Highlights

- Last Meeting
  - Tuesday, March 17th, 2015
  - Shanghai, China

- Next Meeting
  - Friday, July 31st, 2015
  - Qingdao, Shandong, China

- PV Silicon Wafer Task Force
  - Drafting
    - Doc. 5724, New Standard: Guide for Specifying Quasi Monocrystalline Silicon Wafers used in Photovoltaic Solar Cells
    - Doc. 5767, New Standard: Guide for Material Requirements of Internal Feeders Used in Mono-crystal Silicon Growers
    - Doc 5843, Revision of SEMI PV22-1011, Specification for Silicon Wafers for Use in Photovoltaic Solar Cells (New SNARF)

- PV Module Task Force
  - Published
    - SEMI PV44-0513, Specification for Package Protection Technology for PV Modules
    - SEMI PV45-0513, Test Method for the Content of Vinyl Acetate (VA) in Ethylene-Vinyl Acetate (EVA) Applied in PV Modules Using Thermal Gravimetric Analysis (TGA)
    - SEMI PV47-0513, Specification for Anti-Reflective-Coated Glass, Used in Crystalline Silicon Photovoltaic Modules
- SEMI PV61-0115, Specification for Framing Tape for PV Modules (Recently published)
- SEMI PV62-0215, Terminology for Back Contact PV Cell and Module (Recently published)
- SEMI PV63-0215, Specification for Ultra-thin Glasses Used for Photovoltaic Modules (Recently published)
  - Drafting
    - Doc. 5725, New Standard: Practice for Metal Wrap Through (MWT) Back Contact PV Module Assembly
    - Doc. 5830, New Standard: Classification for Electroluminescence Inspection of Crystalline Silicon Photovoltaic Modules
    - Doc. 5840, New Standard: Guide for Calibration of PV Module UV Test Chambers (New SNARF)

- PV Diffusion Furnace Test Methods Task Force
  - Published
    - SEMI PV53-0514, Test Method for In-line Monitoring of Flat Temperature Zone in Horizontal Diffusion Furnaces
  - Drafting
    - Doc 5841, New Standard: Guide for Specifying Low Pressure Horizontal Diffusion Furnace (New SNARF)

- PV Silicon Raw Materials Task Force
  - Published
    - SEMI PV50-0114 Specification for Impurities in Polyethylene Packaging Materials for Polysilicon Feedstock
    - SEMI PV59-0115, Test Method for Determination of Total Carbon Content in Silicon Powder by Infrared Absorption after Combustion in an Induction Furnace (Recently published)
  - Activity:
    - Passed in ballot review, will be submitted to A&R review cycle
    - Doc. 5564B, Test Method for the Measurement of Chlorine in Silicon by Ion Chromatography
    - Doc. 5699, Test Method for Interstitial Atomic Oxygen Content of Crystalline Silicon by Multiple Transmission-reflection Infrared Absorption
    - Doc. 5700, Test Method for Substituted Carbon Content of Crystalline Silicon by Multiple Transmission-reflection Infrared Absorption

- PV Thin Film Task Force
  - Drafting:
    - Doc. 5478: Test Method for Thin-film Silicon PV modules Light Soaking

- PV Power Station Equipment Integrated Performance Task Force
  - Drafting:
    - Doc. 5648, New Standard: Test Method for the Integrated Efficiency of Installed PV Components
    - Failed in ballot review, and return to TF for rework
Doc. 5729, New Standard: Specification for Hotspot in Crystalline Silicon PV Modules in the Field
- These standards are out of SEMI’s scope and PV’s scope. As Lori mentioned, Stone Wu petitioned the ISC for a Power Station committee at SEMICON West last year and failed. Ballot 5648 should never went out in the first place.
- Action Item # 1– Kevin to inform Kris to review these activities with leaders in China and recommend to disband.

- Crystalline Silicon Solar Cell Task Force
  - Published
    - SEMI PV54-0514, Specification for Silver Paste, Used to Contact with N+ Diffusion Layer of Crystalline Silicon Solar Cells
    - SEMI PV58-0115, Specification for Aluminium Paste, Used in Back Surface Field of Crystalline Silicon Solar Cells (Recently published)
  - Drafting:
    - Doc. 5659A, New Standard: Test Method Based on RGB for C-Si Solar Cell Color
      - Passed in ballot review, will be submitted to A&R review cycle
      - Passed in ballot review, will be submitted to A&R review cycle
    - Doc. 5727, New Standard: Test Method for the Etch Rate of A Crystalline Silicon Wafer by Determining The Weight Loss
      - Passed in ballot review, will be submitted to A&R review cycle

- Multi-wire Saws Task Force
  - Drafting:
    - Doc. 5728, New Standard: Test Method for the Wire Tension of Multi-wire Saws (New SNARF)
      - Passed in ballot review, will be submitted to A&R review cycle

- SEMI China Standards Contact: Kris Shen (kshen@semi.org)

Attachment – 7, China Photovoltaic Committee Liaison Report 20150323

5.0 Ballots Review
The ballot received two rejects from Peter Wagner and Andre Dorow.

Motion: To find negative 1 from Peter Wagner is related and technically persuasive
By / 2: Hugh Gotts/Peter Wagner
Discussion: None
Vote: 4-0. Motion passed

This ballot also received two rejects from Peter Wagner and Andre Dorow.

Motion: To find negative 1 from Peter Wagner is related and technically persuasive
By / 2: Hugh Gotts/Peter Wagner
Discussion: None
Vote: 4-0. Motion passed
See attachment for details of rejects.

Attachment – 8, PV Materials Cycle 2-15 ballot results
6.0 Current Activities

6.1 Int'l PV Analytical Test Methods TF/Hugh Gotts (Air Liquide)

- Hugh Gotts reported meeting summary. Highlights.

- SEMI Europe Update
  - Per Peter Wagner, Doc. 5440, Revision to SEMI PV10-1110, Test Method for Instrumental Neutron Activation Analysis (INAA) of Silicon, is still pending.
  - Also, Peter will issue a SNARF to issue for 5 year review for PV10.

- Two ballots were reviewed:

  **Motion:** To authorize these ballots for cycle 4/5 for review at Intersolar NA
  **By / 2nd:** Hugh Gotts/Peter Wagner
  **Discussion:** None
  **Vote:** 4-0. Motion passed

- Old business
    - Evans Analytical Group, which led the round robin, collected the data and is no longer involved with SEMI Standards. Attempts were made in seeking the data be opened, but unsuccessful.
    - **Action Item # 2** - Hugh will reach out to someone in Evans at the management level for a second attempt.
    - Lori was disappointed that there was no contingency plan. Participants in the round robins provided their data and hoped for a precision report, but ultimately kept by Evans. To eliminate future incidents, Lori recommended the data from future round robins should also sent to SEMI staff.
    - Similar to above, data were kept by Evans.
  - Round Robin Update - Test Method For The Measurement Of Elemental Impurity Concentrations In Silicon Feedstock For Silicon Solar Cells By Bulk Digestion, Inductively Coupled-Plasma Mass Spectrometry (Hugh Gotts)
    - Some companies in China are also interested in participating in this round robin. Hugh will contact Kris.

- New business
  - Review of SEMI PV3-0310 GUIDE FOR HIGH PURITY WATER USED IN PHOTOVOLTAIC CELL PROCESSING
  - Review of SEMI PV5-1110 GUIDE FOR OXYGEN (O2), BULK, USED IN PHOTOVOLTAIC APPLICATIONS
  - Review of SEMI PV6-1110 GUIDE FOR ARGON (Ar), BULK, USED IN PHOTOVOLTAIC APPLICATIONS
Review of SEMI PV7-1110 GUIDE FOR HYDROGEN (H2), BULK, USED IN PHOTOVOLTAIC APPLICATIONS
Review of SEMI PV8-1110 GUIDE FOR NITROGEN (N2), BULK, USED IN PHOTOVOLTAIC APPLICATIONS
Review of SEMI PV11-1110 SPECIFICATIONS FOR HYDROFLUORIC ACID, USED IN PHOTOVOLTAIC APPLICATIONS
Review of SEMI PV12-1110 SPECIFICATIONS FOR PHOSPHORIC ACID USED IN PHOTOVOLTAIC APPLICATIONS
All these standards were sent to appropriate expertise. These standards were reported to be current.

Motion: To send all these standards for reapproval
By / 2+: Hugh Gotts/Peter Wagner
Discussion: None
Vote: 4/0. Motion passed

Attachment – 9, 2015 Spring NA PV Standards Analytical TF agenda

7.0 Old Business
All old businesses were completed.

8.0 New Business
Kevin brought up the current charter of PV and PV Materials for review. As the NA PV committee is inactive, he recommended merging with the PV Materials charter. Also, Japan is considering merging both PV and PV Materials as well, see liaison report in section 4.2 above. Taiwan and China has only one PV committee, while Europe, NA and Japan all have PV Materials committee. So it makes sense to align by having one single PV committee covering both PV and PV Materials.

Members reviewed and recommended changes to the PV charter. See attached.

Peter Wagner made a comment saying that merging to one single committee may have an impact on voting return rate due to different interest. Lori agreed and recommended to leave everything unchanged for the time being.

Attachment – 10, Photovoltaic Standards Charter proposed revision

9.0 Next Meetings

10.0 Action Item Review
Summary of action was reviewed by Kevin Nguyen. If any, these can be found in the New Action Items table 7 at the beginning of these minutes.

11.0 Adjourn
Adjournment of the meeting was held at 2:45 PM

These minutes are respectfully submitted by:

Kevin Nguyen,
SEMI Standards Operations Manager
Phone: 408-943-7997
Email: knnguyen@semi.org

Approved by:
Lori Nye (Brewer Science)
Hugh Gotts (Air Liquide)
# Table 8 – Index of Attachment Summary

<table>
<thead>
<tr>
<th>#</th>
<th>Title</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>NAPVMaterialsMeetingMinutes20141105</td>
<td>Taiwan PV Liaison Report Mar 2015</td>
</tr>
<tr>
<td>2</td>
<td>SEMI Staff Report (Spring 2015) rev2</td>
<td>China Photovoltaic Committee Liaison Report20150323</td>
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<tr>
<td>4</td>
<td>141022_Europe_PVMat_LiaisonReport</td>
<td>2015 Spring NA PV Standards Analytical TF agenda</td>
</tr>
<tr>
<td>5</td>
<td>150401_JA_PV&amp;PVM_NA-Spring-2015_R0.1</td>
<td>Photovoltaic Standards Charter proposed revision</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. For additional information or to obtain individual attachments, please contact Kevin Nguyen at the contact information above.