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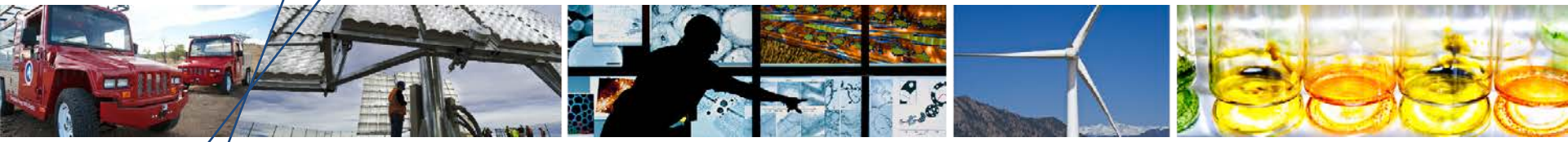
Introduction
to
QA Task Force Thin-Film Workshop



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2013 Thin-Film PV Reliability Workshop

Colorado School of Mines: Golden, CO

NREL/PR-5200-59295

Outline

- What is the International PV Module QA Task Force?
- Summary of the July, 2011 meeting in San Francisco
- Activities of QA Task Force
- Formation and charter of Group 8: Testing for Thin Film PV Modules
- Goal of the Workshop
- Agenda for the Workshop

International PV Module QA Task Force

- **Effort to develop a PV module rating system that meets needs of all countries and customers – A Single Test Protocol**
- **Define concepts for creation of standards that allow stakeholders to quickly assess a module's ability to withstand regional stresses.**
- **Participation open to all who want to contribute to the effort.**
- **Program relies on research done by volunteers around the world.**
- **Effort is to guide world wide research to answer important questions related to testing that predicts outdoor performance of PV modules.**

International PV Module QA Forum

- **Held in San Francisco, CA July, 2011.**
- **Approximately 150 people from around world participated.**
- **Established the International PV Module QA Task Force.**
- **Defined goals of the QA Task Force**
- **Prioritized field failure modes observed for crystalline silicon modules**
- **Established 6 Task Groups, 4 of which were specifically chartered with addressing the prioritized failure modes.**
- **Provided for future creation of additional Groups.**
- **Established a Steering Committee and Team Leaders for each Task Group.**

Goals of International PV Module QA Task Force

1. ***To develop a QA rating system that provides comparative information about the relative durability of PV modules to a variety of stresses as a useful tool to PV customers and as a starting point for improving the accuracy of quantitative PV lifetime predictions.***
   1) Compare module designs
   2) Provide a basis for manufacturers' warranties
   3) Provide investors with confidence in their investments
   4) Provide data for setting insurance rates
2. **Create a guideline for factory inspections of the QA system used during manufacturing.**

QA Task Force Teams Created at QA Forum

Task Group 1: Guideline for Manufacturing Consistency

Task Group 2: Thermal and mechanical fatigue including vibration

Task Group 3: Humidity, temperature, and voltage

Task Group 4: Diodes, shading and reverse bias

Task Group 5: UV, temperature and humidity

Task Group 6: Communication of PV QA ratings to the community

QA Task Force Teams Created since July, 2011

Task Group 7: Wind and Snow Loading

Task Group 8: Thin Film PV

Task Group 9: CPV

We are here to discuss Task Group 8: Testing of Thin Film PV Modules

Activities of Task Group 1

- **Group 1 is writing the PV specific requirements for ISO9001.**
  - **Thin film module manufacturers have been participating**
  - **Expect major portion to be technology neutral.**
  - **May have to add specific sections on each technology**

Activities of Task Groups 2 to 5

- Groups were chartered to look at specific failure modes.
- Evaluating field results
- Defining accelerated stress tests that cause same failures as seen in field.
- Using experiments and modeling to estimate the meaning of the accelerated tests.
- Each group is to propose a test or test sequence that can be used as a tool to compare the lifetime of different module types for those specific failure modes.
- Each group will provide an update at this workshop.

Activities of Task Group 6 and Steering Committee

- **How should the test system be organized?**
- **How should the results be communicated?**
- **Comparative tests versus Qualification Tests**
- **Don’t know enough yet to define service life prediction tests.**

	Qualification	**Comparative**	**Lifetime**
Purpose	Minimum design requirement	Comparison of products	Substantiation of warranty
Quantification?	Pass/fail	Relative	Absolute
Mechanisms studied	Infant mortality	Wear out	Wear out
Climate or application	No differentiation	Differentiated	Differentiated

New Work Item submitted to IEC

- **COMPARATIVE TESTING OF PV MODULES TO DIFFERENTIATE PERFORMANCE IN MULTIPLE CLIMATES AND APPLICATIONS**
- **Not technology specific**

Label \ Stress	Humidity	High Temperature	Thermal cycling	UV
IEC 61215 or IEC 61646	IEC 61215 or IEC 61646	IEC 61215 or IEC 61646	IEC 61215 or IEC 61646	IEC 61215 or IEC 61646
Temperate	IEC 61215 or IEC 61646	IEC 61215 or IEC 61646	Part – 2	Part – 3
Desert	IEC 61215 or IEC 61646	Part – 4	Part – 2 & 4	Part – 3 & 4
Tropical	Part – 5	Part – 4	Part – 2 & 4	Part – 3 & 5

Group 8: Testing of Thin Film PV Modules

- **To extend PV Module QA Task Force work to cover thin film PV modules.**
- **Identify and prioritize the field failure modes observed for thin film PV modules.**
- **From that prioritized list develop and/or define accelerated stress tests that cause the same failure modes as seen in the field.**
- **Use experiments and modeling to estimate the meaning of the accelerated stress tests.**
- **Then propose a test or test sequence that can be a useful tool to compare the lifetimes of different thin film module types for those specific failure modes.**

Goal of this Workshop

- **Prioritize the field failure modes observed for thin film PV modules.**
- **For each of those prioritized failure modes develop a plan for developing the relevant test or test sequence that can be used as a predictor of long term field performance for that specific failure mode.**
- **Options:**
  - **Create new subgroups to investigate specific failure modes**
  - **Work within an existing group (2 to 5 or 7) to make any modifications necessary to extend the work to thin film modules.**

Agenda for the Workshop - Thursday

- **Reports of Task Groups 2 to 5**
  - **Summary of their activities**
  - **Applicability to thin film PV modules**
  - **Discussion on which may be useful for Group 8**
- **Field Experience with thin film modules and packaging materials**
  - **Experience from different locations**
  - **Experience from different viewpoints**
  - **Chance for all of us to share our field experiences with thin film modules**
- **Accelerated Stress Testing applied to thin films**
  - **What tests cause thin film modules and packaging materials to fail**
  - **Special care that must be taken to get meaningful results when testing various thin film technologies**
  - **Discussion about what accelerated stress tests are likely to be useful when testing thin film PV modules**

Agenda for the Workshop - Friday

- **Breakout Session 1**
  - **Prioritize field failure modes for thin film PV modules**
  - **Pick top 4 to 6 failure modes we want to address**
- **Breakout Session 2**
  - **For each of the failure modes selected in Session 1, decide the best way to move forward to identify the appropriate accelerated stress test or test sequence for predicting long term field performance.**

Questions?

http://www.nrel.gov/ce/ipvmqa_task_force/index.cfm

http://pvqataskforceqarating.pbworks.com/w/page/54805161/Thin-film%20Testing