ACCELERATED TESTING REPRODUCING BACKSHEET FIELD OBSERVATIONS

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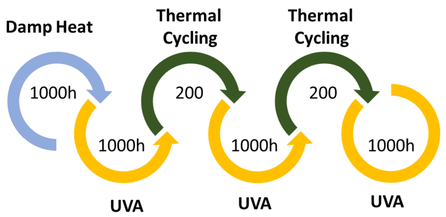
Abstract

PV Evolution Labs (PVEL) subjected a number of backsheet types to a test sequence of accelerated tests including UV, thermal cycles and humidity exposure [1]. This sequence was shown to successfully reproduce some field observations, and in particular some known issues with PET and PVDF based backsheets. In previously-reported data, PVF-based materials were the only backsheets passing the test sequence without significant yellowing nor cracks appearing [1].
PVEL has validated this backsheet durability sequence across several material sets with successful performance by the DSM backsheet and by TPT and effectively identified failure of samples made from other materials. The DSM backsheet system (co-extruded, polyolefin-core) is successful in this study and to date has no reported field failures [2]. These new results increase the confidence for using this test sequence to reproduce the failures modes commonly observed.

Test Method



Characterization Method

Performed after each of the above stress events;

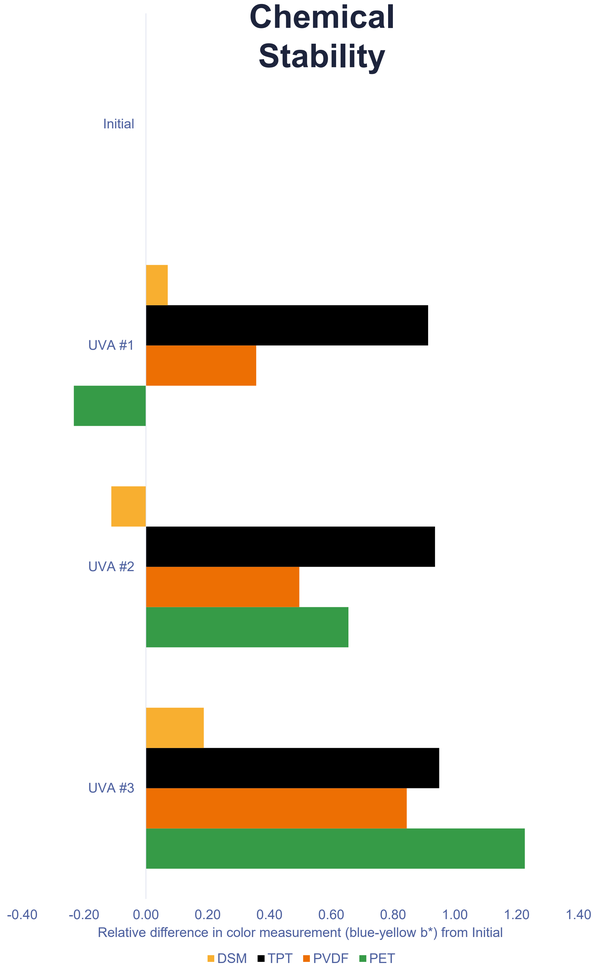
- Maximum Power Determination at STC
- EL Imaging at Short Circuit Current
- Visual Inspection as per IEC 61215
- Colorimeter Measurement
- Wet Leakage Test

Relevance

- Backsheets account for 9-10% of module failures in the field. [3]
- New materials in the market present an unknown with field performance.
- Test sequence can be incorporated into an established qualification program.
- Original test sequence lasts ~9 months.
- Accelerated version under development.

Lab Test Results

Chemical Stability

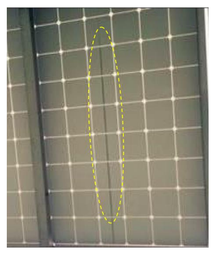


Mechanical Stability

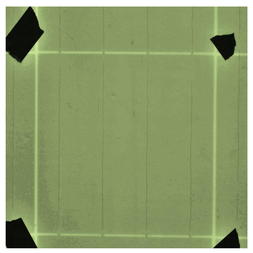
Visual Cracks Observed?				
Type	DSM	TPT	PVDF	PET
After UVA #1	No	No	No	No
After UVA #2	No	No	No	No
After UVA #3	No	No	**Yes**	No

Field Failure vs. Lab Failure

Similar cracks forming along busbar for both fielded modules and product exposed to the entire sequence described.



PVDF backsheet Field Failure after 5 Years [1]



Accelerated Lab Failure of PVDF [1]

Accelerated Lab Failure of PVDF [PVEL]

Summary

- Increased industry awareness and impetus on backsheet evaluation
  - New range of materials and cost reduction
  - Field observed failures within established materials in utility-scale projects
- Growing need for a backsheet test that can generate field representative failures during the product qualification and evaluation phase
- PVEL, in collaboration with industry partners and based on internal R&D, has implemented a robust backsheet evaluation test to re-create these failure modes in months instead of years
- DSM performed this testing with PVEL, showing no visual defects such as cracking and a stable yellowness index
- **Backsheets with known field issues FAIL the test sequence (PVDF and PET)**
- **Backsheets with low or no occurrence of field failures PASS (DSM and TPT)**
- This underscores the fidelity of the test sequence with (2) technologies that are chemically different able to pass this sequence, correlating with field performance

Future Focuses

- Future optimization of the test sequence
  - Duration Reduction
  - Chemical Fingerprinting
- Continued collaboration & annual iterations

References

[1] Choudhury et al., NREL PVRW, 2018
[2] Dross et al., PV ModuleTech, Penang, 2018
[3] Bradley et al., IEEE PVSC New Orleans, 2015

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