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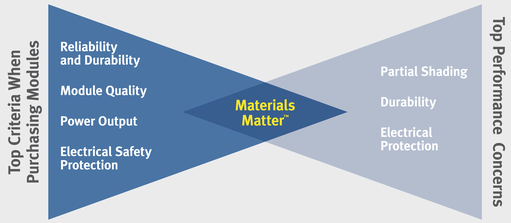
Quality Requirements for Rooftop PV

Top Purchasing Criteria and Performance Issues

2014 Rooftop Installer Survey (EuPD)

Specifying materials reduces performance risks for rooftop installations.

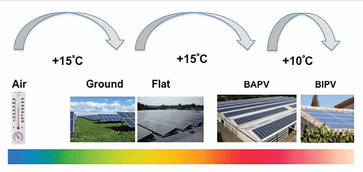


Source: EuPD Research 2014

Thermal Stress Intensifies on Rooftop Installations

Stress Intensity: Operating Temperature

Type of Module Installation Impacts Thermal Stress Level

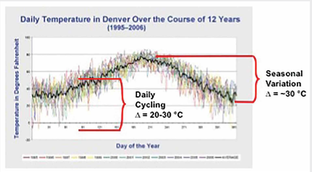


Flat mounted rooftop installation exposed to highest operating temperature and thermal stress.

Source: Creep in Photovoltaic Modules: Examining the Stability of Polymeric Materials and Components (2010)
35th IEEE Photovoltaic Specialists Conference (PVSC '10) Honolulu
David C. Miller, Michael Kempe, Stephen Glick and Sarah Kurtz
Viridian Solar – January 2014

Stress Intensity: Thermal Cycling

Daily and Seasonal Temperature Fluctuations Stress PV Modules

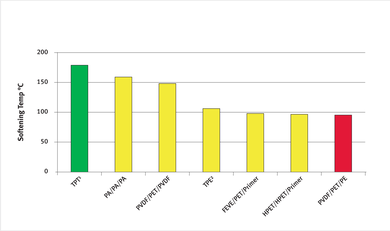


- PV modules experience thousands of thermal cycles over their expected 25+ year lifetime.
- Rooftop installations experience wider range of fluctuations.

Source: http://www.project2061.org/publications/EducatorsGuide/online/Examples/Seasons/seasons.html

Thermal Stability

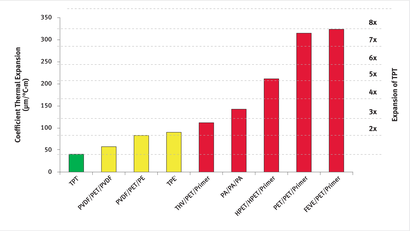
Softening Temperature of Inner Backsheet Layer



¹TPT: Tedlar® PVF/PET/Tedlar® PVF
²TPE: Tedlar® PVF/PET/primer

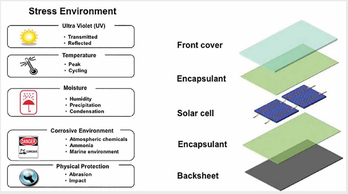
Dimensional Stability

Backsheet's Maximum Coefficient of Thermal Expansion (including Machine Direction & Transverse Direction)



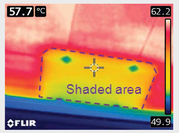
Backsheet: Critical Component for Electrical Protection

Backsheet Impacts PV System Performance



Backsheet must provide reliable electrical protection of module– **even under high thermal stress.**

Diffuse Hot Spots



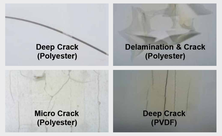
The bypass diode has cut off the affected string with shaded cell.

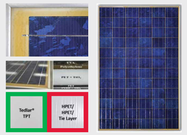
The shaded cell is heating up, showing that the bypass diode has not cut off the affected string (thermal image taken from the back of the panel).

According to PVRessQ study (EUPVSEC, 2010), 47% of the bypass diodes would not function properly.

Fielded Module Observations

Risks Associated with Using Unproven Backsheet Materials

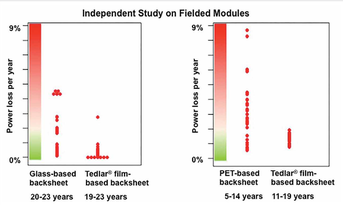




Factors	Operating Temperature, Humidity, Hot Spot, Backsheet Defects Not Visible	UV Irradiation, Operating Temperature, EVA Formulation, Tie Layer Formulation
Risks	Fire Risk, Power Degradation, Loss of Electrical Safety Protection	Aesthetic Degradation, Reduction of Efficiency, Loss of Adhesion to EVA, Loss of Electrical Safety Protection

- Yellowing is one sign of polymer degradation and an early indicator of performance issues.
- Cracking typically is associated with yellowing.
- Backsheet degradation increases potential safety risks such as loss of electrical protection.

Backsheet Durability



Source: Joint Research Centre (Italy); AIST (Japan)

Backsheet can significantly impact the long-term power output of the PV module, affecting both the LCOE and IRR.

Summary

- Electrical safety protection is one of the most critical attributes for (PV) rooftop installers.
- Modules deployed on rooftops are exposed to higher thermal stress. This can accelerate the deterioration of the backsheet electrical protection.
- Tedlar®/polyester/Tedlar® (TPT) backsheet provides the highest thermal stability with consistent adhesion to EVA, thereby reducing risk of cracking, blistering and delamination, ensuring reliable lifetime and higher return on investment.

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