Australian Government
Australian Renewable Energy Agency

ARENA

Lessons Learnt

Lessons Learnt Report: *Suitability of ultra-violet light transparent encapsulant for use PV modules*

Project Name: *Photovoltaic Modules for the Australian Environment (PV-MATE)*

Knowledge Category:	Technical
Knowledge Type:	Technology
Technology Type:	Solar PV
State/Territory:	Canberra ACT, Coledale NSW

Key learning

PV module encapsulant, commonly termed EVA, as they are primarily based on ethylene-vinyl acetate with additives (Kempe 2005), typically had ultra-violet radiation absorbers. The absorbers, similar to the sunscreen for humans, prevent highly ionising ultra-violet (UV) solar radiation from damaging components of the solar panel. However, we have deduced from literature and direct consultation with PV encapsulant suppliers that PV panel manufacturers are using or experimenting with using EVAs without UV absorbers. The motivation is that for advanced solar cells the UV transparent EVA (UVT EVA) leads to a 1%-2% improvement in measured power (Khoo, Walsh et al. 2012). We investigate the optical durability of standard UV blocking compared to UVT EVA. After DH exposure, any improvement from the UVT material is lost. That is, the transmission is the weight transmission of the UVT material is reduced to a level equivalent to the UV blocking material. These tests are not indicative of material failure, but indicate that if the UVT materials are employed, care should be taken to assess possible impacts on reliability.

Implications for future projects

From this study of UVT materials we will expand it to determine if the mechanical properties of the UVT materials suffer compared to the standard materials. The discovery of these degrading effects are an important issue to follow up as it may impact the current and future installed PV module fleets in Australia.

Knowledge gap

UVT materials can clearly boost module power, however are the gains in power worth an effect on reliability? This issue is still quite unclear, however for the materials studied in this work, it is apparent that the UVT materials are less stable when exposed to damp heat.

Background

Objectives or project requirements

A key object of the PV-MATE project that this work addresses is to:

“To source and test new components for module manufacture”

Using UVT material if they do not degrade could be an effective means of increasing PV panel productivity in Australia.

Process undertaken

4 UVT and standard EVA from 4 manufactures were cured. Then exposed to:

- Damp heat 85 °C/85% relative humidity
- Exposed to a UV lamp, at least equivalent to IEC61215 testing exposure
- Re-exposed in the reverse order

After each step the spectrum and IQE weighted transmission was measured for each sample. The effects pre and post-accelerated condition exposure was compared.

Supporting references

Arndt, R. and R. Puto (2010). "Basic understanding of IEC standard testing for photovoltaic panels." Compliance Magazine.

Kempe, M. D. (2005). Control of moisture ingress into photovoltaic modules. Photovoltaic Specialists Conference, 2005. Conference Record of the Thirty-first IEEE.

Khoo, Y. S., et al. (2012). "Method for quantifying optical parasitic absorptance loss of glass and encapsulant materials of silicon wafer based photovoltaic modules." Solar Energy Materials and Solar Cells 102(0): 153-158.

McIntosh, K. R., et al. (2011). "The effect of damp-heat and UV aging tests on the optical properties of silicone and EVA encapsulants." Progress in Photovoltaics: Research and Applications 19(3): 294-300.

Miller, D. C., et al. (2015). Degradation in PV encapsulation transmittance: an interlaboratory study towards a climate-specific test. Photovoltaic Specialist Conference (PVSC), 2015 IEEE 42nd, IEEE.

Osterwald, C. R. and T. J. McMahon (2008). "History of Accelerated and Qualification Testing of Terrestrial Photovoltaic Modules: A Literature Review." Progress in Photovoltaics: Research and Applications 17: 11-33.