Degradation Science Approach to Photovoltaic Module Backsheets

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Photovoltaic (PV) modules are rapidly gaining market share around the world. Understanding the degradation mechanisms in PV modules is key to increasing the power performance for these long-lived systems. The lifetime of modules based on the wide variety of stressors that modules experience and the large number of materials. PV module backsheets are generally three layered polymer films with a polyethylene terephthalate core layer that provide an environmental and safety barrier on the backside of a module. These polymers films have cracked, embrittled and delaminated in fielded modules even though the polymers have passed standard accelerated exposure testing. A lifetime and degradation science approach was applied to predict the lifetime of PV module backsheet materials under accelerated conditions and to then cross-correlate the degradation to real-world field conditions. We have have developed statistical models for lifetime predictions based on stress and material responses (<Stress|Response> models) for backsheet films. These <Stress|Response> models can be cross-correlated to determine the cross-correlation factor for accelerated exposures on how well they mimic real-world degradation mechanisms and responses. Additionally, we have developed an optical profilometry method to quantify the cracking present in these backsheet films.