BACKFLIP: A Comparison of Emerging Non-Fluoropolymer-Based, Co-Extruded PV Backsheets to Industry-Benchmark Technologies

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Abstract:

As the photovoltaic (PV) industry is rapidly expanding around the world, there has been an increasing interest in extending the lifespan of PV modules. Concern has also emerged regarding the recyclability of modules and their component materials, including fluoropolymer-based backsheets. Laminated polyethylene-terephthalate (PET) core backsheets have traditionally been used in the PV industry, but new, co-extruded polyolefin (PO) backsheets show promise as an improved alternative. Mini-module and coupon samples of seven different backsheets (made of layers including contemporary PET and fluoropolymers, novel PO, and polyamide (PA) materials) were run through hygrometric- or UV photolytic-accelerated aging to identify and better understand each material's degradation modes and the backsheets' field reliability. In addition to the artificial aging, the natural weathering methods used in this study are described. The comprehensive set of chemical, mechanical, and structural characterizations at intermittent read points in this study is presented, including visual appearance and color; gloss; mechanical tensile testing; I-V performance; electroluminescence (EL) imaging; dielectric breakdown; FTIR-chemical structure; X-ray-polymer structure (WAXS); and DSC-crystalline content. After 4000 h of aging, a strong correlation occurs between initial physical characteristics (mechanical tensile test) and operating performance (EL and I-V characteristics).

Biography:

David Miller has a background in mechanical engineering with emphasis on materials science. He earned a bachelor's degree from the University of Minnesota and master's degree and doctoral degrees from the University of Colorado at Boulder. David specializes in the reliability of PV packaging materials. His current activities include research on: UV weathering of encapsulants, backsheets and balance of systems components; abrasion and contamination of anti-reflective/anti-soiling coatings; and the characterization of PV packaging materials. David is a project leader and contributor for industry standards related to characterization and durability of PV packaging materials, including the IEC 62788-series within the IEC TC 82 Working Group 2 (PV modules). David also hosts groups within the international PV Quality Assurance Task Force (PVQAT), including Task Group 5 of, focusing on UV weathering of encapsulant materials; PVQAT Task Group 12-3, focusing on the abrasion of incident surfaces; and a combined industry group on BoS reliability.