

## Lightweight and durable PVDF-SSPF composites for photovoltaics backsheet applications: thermal, optical and technical properties

### ABSTRACT

Photovoltaic module backsheets are characterized according to their thermal, optical, mechanical, and technical properties. This work introduces new fabricated backsheets for PV modules using polyvinylidene fluoride (PVDF) reinforced with short sugar palm fiber (SSPF) composites. The preparation of composites undergoes multiple phases of fabrication. Thermal, optical, and technical investigations of their properties were conducted. Fourier transform infrared spectroscopy (FTIR), Raman spectroscopy, in-situ scanning probe microscopy (SPM), dynamic mechanical analysis (DMA), thermal mechanical analysis (TMA), thermogravimetric analysis (TGA), differential scanning calorimetry (DSC), and prolonged technical testing were accomplished to expansively understand the complex behavior of composites under various conditions. The optical properties of PV backsheets are critical components in determining the reflectance, absorbance, and transmittance of light. The PVDF–SSPF composites exhibited exceptional compatibility and thermal stability, further revealing a homogenous composite structure with enhanced interfacial bonding between the short fiber and polymer matrix.

**Keyword:** Photovoltaic applications; Backsheets; Natural fiber composites; Optical properties; Thermal properties; Technical properties