

Solvent Delamination for Photovoltaic Module with Polyolefin Elastomer Encapsulation Layer

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Abstract

The first step of high-quality photovoltaic (PV) module recycling is delamination, a process that aims to remove the encapsulation layer between glass and solar cells. Various methods have been investigated for the delamination of ethylene-vinyl acetate (EVA) polymer. However, the solvent delamination of polyolefin elastomer (POE) encapsulant in photovoltaics has not been described. Our research aims to present the approach of it. Its significance increases as polyolefins are expected to become the dominant polymer in PV encapsulation within the next 10 years. We used a monocrystalline glass-glass PV module with POE encapsulation layer for the research. The module was cut into samples conforming to the structure of the module. The samples were immersed into six solvents under the specified conditions. The results showed that three solvents (acetone, dimethyl sulfoxide, and isopropanol) had no effect on structural changes. Two solvents (tetrahydrofuran, and dimethylcyclohexylamine) presented swelling of POE. The solvent was absorbed by the polymer, causing an increase in the volume of samples, however, the layers remained connected. The test with ethylene glycol allowed to separate clean glass that can be used for the manufacture of new products without additional cleaning. Even though the links between glass and encapsulation layer were detached, ethylene glycol was unable to completely dissolve the polymer. The solar cells remained encapsulated in polymer on both sides. They require additional processing (e.g., thermal treatment) to remove the polymer for metal recovery from solar cells.

Keywords

Encapsulation Layer, Polyolefin Elastomer, Solvent Delamination, Recycling

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