Enhancement of resistance against damp heat aging through compositional change in PV encapsulant poly (ethylene-co-vinyl acetate)

Abstract:

The most common encapsulant used in the photovoltaic (PV) modules is poly (ethylene-co-vinyl acetate) (PEVA). The characteristics of PEVA can be varied by modulating its vinyl acetate (VA) content. According to the general consensus within the PV industry, PEVA as an encapsulant should have VA content between 28 and 33%.

Degradation of PEVA films due to environmental stressors like humidity, temperature and solar radiation in the field aged modules is not uncommon. Moreover, degradation of PEVA encapsulant implies a concomitant loss in the electrical performance of the PV modules. VA content modulation especially outside the most commonly used and accepted range has been tried in this study to improve the damp heat aging resistance of PEVA films. PEVA films containing 18, 24, 33, and 40% VA content with the necessary additives have been fabricated and cured at 150°C under vacuum and subsequently subjected to accelerated damp-heat (85◦C and 85% RH) aging according to IEC 61215 standard for 1000 and 2000 h. Tensile strength, thermal stability and degree of crosslinking have been found to be greater for PEVA containing lower VA content (18 and 24%) and diminished for PEVA with higher VA content (33 and 40%) due to DH aging. However, inadequate % transmittance and relatively high stiffness after 2000 h of DH aging discourages PEVA18 as an encapsulant. Moreover, PEVAs with higher VA content (33 and 40%) have been degraded significantly after 2000 h of DH aging resulting in significant loss in transmittance and mechanical integrity. Therefore, the results of this investigation encourage the PV industry to reduce the VA content in PEVA down to 24% for better encapsulation response against DH aging.

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