Comparison of UV-Curing, Hotmelt, and Pressure Sensitive Adhesive as Roll-to-Roll Encapsulation Methods for Polymer Solar Cells - DTU Orbit (07/12/2018)

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The most distinct advantage of the polymer solar cell is the possibility for roll-to-roll (R2R) fabrication compatibility based on printing and coating processes. The R2R encapsulation is the last crucial process step in the manufacturing workflow and is evaluated in this study. Polymer solar cell modules are directly printed on barrier foil and encapsulated with the same barrier foil either on the backside or on both sides of the device. The three lamination methods comprise of UV-curable epoxy resin, hotmelt, and pressure sensitive adhesive (PSA). It is shown that a single sided encapsulation with UV-curable adhesive is enough to achieve the same or better lifetime than double-sided encapsulation with all the adhesives utilized here. This is mainly due to the good edge sealing effect of the thin adhesive with no edge bleaching after 900 h of constant illumination. Although the fabrication of the PSA method is the fastest method (in this study) it generates a considerable amount of waste (paper liner) and two lamination steps are required to achieve a sufficient lifetime. We conclude that UV-curing presents the largest advantages of all methods with a good upscaling potential and low embodied energy due to the possibility for single sided encapsulation.

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