Testing Delamination in OPV Devices: A Study of Materials influence on Mechanical Properties

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MOTS-CLEFS : *adhesion, delamination, interface, stability*

Organic photovoltaic (OPV) devices are one of the most promising applications of organic semiconductors. While the electrical failure mechanisms in OPV devices have been thoroughly investigated, little is known about their mechanical stability, which is as important and critical to ensure long term reliability [1]. The characteristic thin films stresses of each layer provide the mechanical driving force for delamination of weak interfaces, leading to a loss of device integrity and performance [2].
In this study, we developed a technique to probe weak layers or interfaces in inverted devices, as presented in the Figure 1, establishing a new set-up for the so-called probe tack making it similar to a pull-off test [3], with an improved control on the test parameters. The technique has been developed using an inverted device, with the structure ITO/ZnO/P3HT:PCBM/PEDOT:PSS/Ag. The delamination was localized at the active layer/hole transporting layer interface, in good agreement with the literature [1,2].

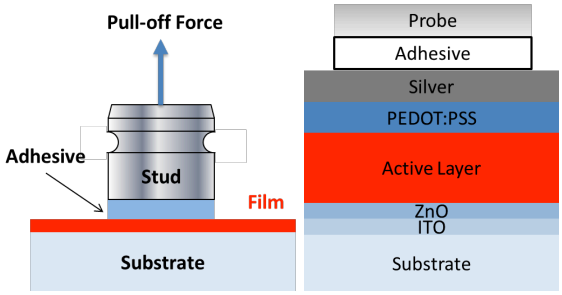

Fig. 1: set-up of the probe tack technique and architecture of the inverted device

The technique has been extended varying both sensitive layers, using different p-type low bandgap polymers for the active layer in combination with two different PEDOT:PSS formulations (CleviosTM HTL Solar and HTL CleviosTM Solar 2). After mechanical tests, the upper and lower surfaces have been characterized by contact angle, AFM and XPS to locate the fracture point.

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