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Tesis: "DESIGN OF STABLE ORGANIC SOLAR CELLS AND PEROVSKITE SOLAR CELLS USING ADHESIVES AS ENCAPSULANTS"

Resumen:

Organic solar cells (OSCs) have recently been one of the promising photovoltaic (PV) technologies with numerous advantages, including reasonable power conversion efficiencies (PCEs), bandgap tunability, easy processability, low cost, and flexibility. On the other hand, perovskite solar cells (PSCs) have surprisingly emerged as highly efficient solar cells due to their unprecedented rise in PCE within the last decade. Nonetheless, extrinsic instability due to moisture and oxygen remains one of the serious problems preventing the commercialization of these devices. Encapsulation has been suggested as one of the most attractive techniques to enhance external stability. Despite their differences in terms of charge generation, OSCs and PSCs share similar materials processing, therefore, standard strategies have been developed for both of them. Herein, we aimed to design stable OSCs and PSCs using three encapsulation materials, namely Norland optical adhesive 65 (NOA 65), NOA 71, and Ossila encapsulation epoxy (OEE). The PV parameters, such as PCE, short-circuit current density (Jsc), open-circuit voltage (Voc), and fill factor (FF), were monitored for 20 days after encapsulation. Our results reveal the effect of using encapsulants on device stability. OEE had the highest performance retention of 93% and 86% in OSC and PSC, respectively, and was attributed to the trade-offs between a combination of indicators, especially water vapor transmission rate (WVTR), oxygen transmission rate (OTR), adhesion, optical performance, and refractive index. NOA 71 was second, retaining 91% and 80%, in OSC and PSC, respectively, while NOA 65 came third, retaining 87% and 78% in OSC and PSC, respectively. However, the OEE's higher cost may potentially increase the overall device production costs. Therefore, future studies could assess the economics and include more encapsulation materials to conclusively identify the adhesive(s) that optimizes both device cell efficiency, durability, and cost.