PÔSTER - RESUMO - DISPOSITIVOS OPTOELETRÔNICOS

CUSTOM SYNTHESIZED FOR PEDOT:PSS: THE CRITICAL ROLE OF PSS MOLECULAR WEIGHT ON OPV PERFORMANCE

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Poly(3,4-ethylenedioxythiophene):poly(styrenesulfonate) (PEDOT:PSS) has been the standard hole transport layer (HTL) in organic photovoltaics (OPVs) due to its high work function and ease of processing [1]. However, the molecular weight (Mw) of the PSS insulating component plays a critical role in determining the morphology and electrical properties of the film. Therefore, in this work PSS with varying molecular weights (157, 80, 47, 38, and 23 kDa) were synthesized to formulate customized PEDOT:PSS inks and investigated their impact on OPV performance. For this purpose, organic solar cells were fabricated using these custom inks as the HTL and compared them against two commercial references: Clevios™ P VP AI 4083 and Polaraci C (Emat Inc., Brazil) [2]. The devices were characterized using current density-voltage (J-V) curves, atomic force microscopy (AFM), conductivity measurements, and transient photovoltage/photocurrent (TPV/TPC) analyses. The results reveal a clear inverse correlation between PSS molecular weight and power conversion efficiency (PCE). As the PSS Mw decreases from 157 kDa to 23 kDa, the short-

circuit current density (Jsc) increases significantly, reaching a peak of 28.3 mA/cm² for the 23 kDa sample. This improvement in charge collection compensates for a reduction in fill factor (FF), leading to a maximum PCE of 13.18%, which is comparable to the high-efficiency commercial references (13.26% for 4083 and 13.66% for Polaraci C). On the order hand, AFM analysis suggests that lower Mw PSS promotes better phase separation and potentially higher conductivity, while transient measurements indicate reduced recombination losses in the optimized devices. This study emphasizes the importance of tailoring the PSS molecular weight in PEDOT:PSS synthesis to maximize the performance of organic solar cells.

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References:

[1] Y. Tong, B. Xu, and F. Ye, Adv. Funct. Mater., vol. 34, no. 10, p. 2310865

[2] G. D. Gómez Higuita et al.,Mater. Adv., vol. 6, no. 17, pp. 6066–6075, 2025

Palavras-chave: organic solar cells; pedot:pss; molecular weight; performance; hole transport layer.