PÔSTER - RESUMO - DISPOSITIVOS OPTOELETRÔNICOS

INVESTIGATING THE EFFECTS OF (3-GLYCIDYLOXYPROPYL)TRIMETHOXYSILANE (GOPS) ADDITION IN THE HOLE TRANSPORT LAYER OF SINGLE-JUNCTION ORGANIC SOLAR CELLS

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Organic solar cells (OSCs) have experienced significant progress in recent years, achieving power conversion efficiencies (PCEs) above 19% in single-junction devices and emerging as promising candidates for lightweight, flexible, and low-cost photovoltaic technologies. Despite these advances, their widespread commercialization is still limited by degradation mechanisms that compromise both efficiency and long-term operational stability. Among the various sources of instability, the hole transport layer (HTL) plays a crucial role in determining device durability and charge extraction efficiency. The most commonly employed HTL material, PEDOT:PSS, is intrinsically hygroscopic and readily absorbs moisture from the environment. Water uptake disrupts hydrogen bonding within the PSS chains, increases interchain distances, and reduces film conductivity, ultimately leading to poor charge transport and accelerated performance losses under humid conditions.

In this work, we investigate the incorporation of (3-glycidyloxypropyl)trimethoxysilane (GOPS), a silane-based crosslinking agent known to improve chemical robustness and water resistance in polymer thin films, into PEDOT:PSS layers used in OSCs. The main objective is to mitigate humidity-induced degradation while preserving or enhancing the electrical properties of the HTL. Different GOPS concentrations are systematically introduced into the PEDOT:PSS solution to evaluate the balance between enhanced stability and possible conductivity reductions caused by excessive crosslinking.

Device performance is assessed through detailed photovoltaic characterization, including measurements of open-circuit voltage (Voc), short-circuit current density (Jsc), fill factor (FF), and overall PCE. Morphological and nanoscale structural changes induced by GOPS incorporation are analyzed using atomic force microscopy (AFM) to establish correlations between surface features and charge transport behavior. In addition, device reliability is evaluated through accelerated aging tests conducted according to the ISOS protocol under controlled indoor humidity conditions, enabling a quantitative comparison of stability improvements.

Overall, this study provides a comprehensive understanding of how GOPS-modified PEDOT:PSS influences the electrical, morphological, and stability properties of OSCs, contributing to the development of more robust and moisture-resistant HTLs and supporting the advancement of durable, high-efficiency organic photovoltaic technologies for practical applications.

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Palavras-chave: organic solar cells; pedot:pss; gops crosslinking; humidity stability; hole transport layer.