

Influence of TiO_2 and SnO_2 Nanoparticle Thin Films Deposited by Pulsed Laser Deposition on Organic Solar Cell Performance

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Abstract:

The main limitations of organic cells (OSCs) are their low operational lifetime and efficiency. The electron transport layer (ETL) is a key component in OSCs, significantly influencing the efficiency and lifetime of the device. Tin oxide (SnO_2) and titanium dioxide (TiO_2) are among the most widely employed as ETL materials in OSCs, owing to their favorable optoelectronic properties and excellent chemical stability, these materials have attracted considerable research interest in recent years. In this study, a comparative investigation was conducted on SnO_2 and TiO_2 nanoparticles (NPs) deposited by pulsed laser deposition (PLD) as ETLs in inverted organic solar cells employing (PTB7-Th: O-IDTBR) as the active layer. The results revealed that the OSCs incorporating a SnO_2 electron transport layer exhibited a higher power conversion efficiency (PCE) than those based on TiO_2 . Specifically, the devices with SnO_2 achieved a PCE of (19.0%), whereas those employing TiO_2 reached a PCE of (16.95%). The OSCs with SnO_2 showed a degradation time lower than that of TiO_2 under the same ambient air conditions and illumination.