

Interface Engineering of TiO₂/Sb₂S₃ Thin Film Solar Cells Deposited by Spray Pyrolysis

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Abstract: Interface engineering plays a critical role in improving the performance of Sb₂S₃ thin-film solar cells based on earth abundant materials. In this work, the introduction of a zinc oxide (ZnO) thin film as an interlayer between TiO₂ and Sb₂S₃ is proposed to improve the interface quality and facilitate charge transport across the device structure. ZnO is widely used as an electron transport material due to its wide band gap and relatively high electron mobility which may improve the charge extraction and reduce interfacial recombination. The multilayer structure was fabricated using spray pyrolysis deposition. In particular, the spray process was performed under a nitrogen atmosphere using nitrogen gas as the carrier, which avoids possible formation of oxides [2] and better control over the deposition environment and improved film quality. To investigate the role of the interlayer, different ZnO deposition times were tested to tune the thickness of the ZnO layer and evaluate its influence on the properties of the heterostructure. The resulting films were studied through structural, optical, and morphological characterization to better understand how the ZnO interlayer affected the interface between TiO₂ and Sb₂S₃. Attention was given to the influence of the ZnO interlayer on the structural quality and interface properties of the TiO₂/Sb₂S₃ heterostructure.

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Keywords: Interface engineering, solar cells, Sb₂S₃ thin films, Spray pyrolysis

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