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Optimization of TiO2 processing parameters using the slot die-coating technique for dye-sensitized solar cells.

Dye-sensitized solar cells (DSSCs) are photovoltaic devices that provide high solar to electric energy conversion efficiency through light sensitization of metal oxides by adsorbed dyes. Recently, considerable research has focused on enhancing the efficiency of DSSCs by improving individual elements of the device. Among all the elements, porous TiO2 thin-films sensitized with light-absorbing dyes play a vital role as photoanodes, which function as charge collectors for the dye molecules in a DSSC. This research aims to optimize TiO2 thin films for enhanced DSSC performance.
In this study, TiO2 thin-films were optimized through several processing parameters, namely deposition time, film thickness, and annealing temperature, using the slot die-coating technique for DSSC applications. The structural properties and crystallinity of the prepared films were examined using X-ray diffraction (XRD) and RAMAN spectroscopy, respectively. The surface morphology and the cross-sectional view of the films were investigated using the Field Emission Scanning Electron Microscope (FE-SEM). Ultraviolet–visible spectroscopy (UV-Vis) was used to study the photoabsorbance of the films. Atomic Force Microscopy (AFM) was used to study the roughness of the films. Lastly, the thin films were sensitized with anthocyanin dye and employed as photoanodes in DSSC devices to study their electrochemical properties. This study will be a pathway to forming highly efficient photoanodes which exhibit enormous potential in the hydrogen production and bioenergy industry.

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