Abstract

In DSSCs, photoanode is an important component for photon absorption and electron transport. In this work, we have synthesized photo-anode material (MXene/TiO_2/SnO_2) for Dye-sensitized solar cells. TiO_2/SnO_2 composites were synthesized using the hydrothermal technique. The sample was sintered at 200 ℃ for 10 hours. MXene (Ti_3C_2) was added to the pure sample (TiO_2/SnO_2) with the optimal range of 10%, 20%, 30%, and 50% respectively. Different characterization techniques such as XRD, FESEM, EDX, and UV-vis spectroscopy were used to examine the effect of MXene on the pure sample. The structural analysis of the five samples reveals that the samples exhibited very sharp peaks that reflect the crystallinity of the material. XRD of pure TiO_2/SnO_2 depicts the tetragonal structure by comparing it with the standard data card (00-001-0657). After the addition of MXene to the pure sample, the resultant peaks of the synthesized material correspond to the TiC anatase phase with a cubic crystal structure compared with the standard data card (00-003-1213). A decrease in the crystallite size is observed by the addition of MXene. The morphology of the prepared composite was confirmed by Scanning Electron Microscope (SEM). Also, Energy Dispersive X-Ray (EDX) technique was used for the quantitative and qualitative elemental analysis of the material. EDX shows the qualitative and quantitative contents of elements in pure TiO_2/SnO_2 and MXene Composites like Ti, Sn, Cl, C, and O. UV-visible spectroscopy exhibits a decrease in the direct band-gap from 3.20 eV to 2.83 eV due to the addition of MXene to the pure sample (TiO_2/SnO_2). All these results show that MXene composite TiO_2/SnO_2 materials are a potential candidate as photo-anode material for dye-sensitized solar cells.