2020 VIRTUAL MRS® SPRING/FALL MEETING & EXHIBIT
November 27 – December 4, 2020

F.SM04.06.07 Transparent and Conductive F-Doped SnO2 Nanostructured Thin Films by Sequential Nebulizer Spray Pyrolysis

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Transparent conductive oxides (TCO) are a key component in many optoelectronic applications such as solar cells, flat panel displays, sensors, touch screens, light-emitting diodes, frost-resistant surfaces, and smart windows. The high electronic conductivity and high optical transmission are essential properties of TCOs for these applications. Owing to chemical inertness and high-temperature tolerance of F- doped tin oxide (FTO) films, they also have much demand in a variety of electrochemical devices. In this work, transparent and electrically conductive FTO thin films are prepared on soda-lime glass substrates. The films are fabricated by sequential nebulized spray pyrolysis with the help of a homemade low-cost spray gun. The surface morphology of the films is analyzed using scanning electron microscopy (SEM). It is found that surface is homogeneous and FTO crystallite sizes are in the order of ~10 nm. XRD pattern of the FTO films exhibits 2? peaks for corresponding SnO2 crystal planes at 26.64° (110), 33.90° (101), 37.95° (200), 51.87° (211), 56.17° (200), 60.05° (310), 61.89° (301). The crystallite sizes calculated from XRD data are in agreement with that of SEM. Optical transparency and bandgap energies are evaluated by UV visible spectroscopy. The FTO films with 15 cm^{-2} sheet resistance are used to prepare quasi-solid-state dye-sensitized solar cells with a TiO2 photoelectrode. The solar cell showed a ~ 5% energy conversion efficiency with high short-term stability.

Keywords: nanostructure, crystal growth, spray deposition