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Highly Oriented and Conducting SNO2 Doped Al and SB Layers Grown by Automatic Spray Pyrolysis Method

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Abstract : The principal aim of this study is to considerably reduce the resistivity of the SnO2 thin layers. In this order, we have doped tin oxide with aluminum and antimony incorporation with different atomic percentages (0 and 4%). All the pure and doped SnO2 films were grown by simple, flexible and cost-effective Automatic Spray Pyrolysis Method (ASPM) on glass substrates at a temperature of 350 °C. The microstructural, optical, morphological and electrical properties of the films have been studied. The XRD results demonstrate that all films have polycrystalline nature with a tetragonal rutile structure and exhibit the (200) preferential orientation. It has been observed that all the dopants are soluble in the SnO2 matrix without forming secondary phases. However, dopant introduction does not modify the film growth orientation. The crystallite size of the pure SnO2 film is about 36 nm. The films are highly transparent in the visible region with an average transmittance reaching up to 80% and it slightly reduces with increasing doping concentration (Al and Sb). The optical band gap value was evaluated between 3.60 eV and 3.75 eV as a function of doping. The SEM image reveals that all films are nanostructured, densely continuous, with good adhesion to the substrate. We note again that the surface morphology change with the type and concentration dopant. The minimum resistivity is 0.689*10-4, which is observed for SnO2 film doped 4% Al. This film shows better properties and is considered the best among all films. Finally, we concluded that the physical properties of the pure and doped SnO2 films grown on a glass substrate by ASPM strongly depend on the type and concentration dopant (Al and Sb) and have highly desirable optical and electrical properties and are promising materials for several applications.

Keywords : tin oxide, automatic spray, Al and Sb doped, transmittance, MEB, XRD and UV-VIS
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