

Effect of Substrate Temperature on Structure and Properties of Sputtered Transparent Conducting Film of La-Doped BaSnO₃

Authors : Alok Tiwari, Ming Show Wong

Abstract : Lanthanum (La) doped Barium Tin Oxide (BaSnO₃) film is an excellent alternative for expensive Transparent Conducting Oxides (TCOs) film such as Indium Tin Oxide (ITO). However single crystal film of La-doped BaSnO₃ has been reported with a good amount of conductivity and transparency but in order to improve its reachability, it is important to grow doped BaSO₃ films on an inexpensive substrate. La-doped BaSnO₃ thin films have been grown on quartz substrate by Radio Frequency (RF) sputtering at a different substrate temperature (from 200°C to 750°C). The thickness of the film measured was varying from 360nm to 380nm with varying substrate temperature. Structure, optical and electrical properties have been studied. The carrier concentration is seen to be decreasing as we enhance the substrate temperature while mobility found to be increased up to 9.3 cm²/V-S. At low substrate temperature resistivity found was lower ($< 3 \times 10^{-3}$ ohm-cm) while sudden enhancement was seen as substrate temperature raises and the trend continues further with increasing substrate temperature. Optical transmittance is getting better with higher substrate temperature from 70% at 200°C to $> 80\%$ at 750°C. Overall, understanding of changes in microstructure, electrical and optical properties of a thin film by varying substrate temperature has been reported successfully.

Keywords : conductivity, perovskite, mobility, TCO film

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