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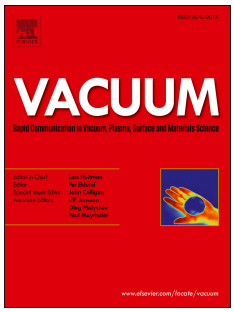

Influence of sulfurization time on two step grown SnS thin films

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Influence of sulfurization time on two step grown SnS thin films

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Abstract

SnS thin films were prepared using a simple two-stage process. The two-stage process involved in sputtering of Sn over glass substrate followed by sulfurization of sputtered Sn at 350 ^{o}C. The sulfurization process was carried out in the ambience of sulfur for different time lengths, 10-120 min. and its influence on physical properties are reported. XRD study showed that the films sulfurized at 10 min. were poor in crystallinity with reflections of un-reacted tin and sulfur. As the sulfurization time (S_t) is increased to 60 min., a single phase orthorhombic SnS was observed with (111) preferred plane. Four distinct Raman modes at 95, 163, 190 and 220 cm^{-1} confirms the formation of SnS for S_t > 30 min., however, S_t < 30 min. treated Sn films had extra Raman peak at 489 cm^{-1} related to S_x phase. The ratio of Sn/S was found to be 2.92 for 10 min. and reached stoichiometric ratio with densely packed grain morphology for 60 min. The optimized films showed a direct band-gap of 1.35 eV. The XPS oxidation states of Sn and S were found to be (+2) and (-2), indicating the formation of SnS. The S_t dependent electrical measurements are also reported and discussed.