Structural Aspects of Wet Chemical Deposited SnS Films

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An earth-copious, inexpensive and non-toxic absorber is needed for PV modules to replace the current developed technologies which are limited by their toxicity, scarcity and exorbitant cost. Tin sulphide (SnS) is an auspicious binary compound semiconductor for making scalable, affordable, innocuous absorber for PV cells. In the present investigation, polycrystalline SnS films were successfully grown by a simple wet technique, chemical bath deposition, using stannous chloride and thioacetamide as precursors by varying bath temperature (T_b) in the range, 40 - 80 ^{o}C. The structural properties of as-prepared films were characterized by XRD and Raman studies respectively, the corresponding profiles are shown in Fig. 1. The diffraction analysis demonstrated that all the deposited films were polycrystalline in nature with the presence of (111) plane at 31.6^{o} as the preferred orientation and exhibited orthorhombic crystal structure. The films grown at lower T_b (< 60 ^{o}C) showed peaks related to (021), (101), (131) and (112) planes of SnS. The intensity of (111) peak was increased with T_b and got maximum at 70 ^{o}C, then slightly declined. Simultaneously the other peaks were suppressed, which indicated that the films were highly oriented along (111) plane with T_b up to the optimum [1]. The position of (111) peak was unaltered as T_b increases which revealed that the structure of SnS layers remain same although the T_b was changed in the range, 40 - 80 ^{o}C. Raman spectra showed four characteristic Raman modes of SnS layers at 94 cm^{-1}, 160 cm^{-1}, 191 cm^{-1} and 217 cm^{-1} which corresponded to the orthorhombic structure of SnS. The phonon modes at 94 cm^{-1}, 191 cm^{-1} and 217 cm^{-1} were assigned to A_g mode whereas 160 cm^{-1} was ascribed to B_{2g} mode [2, 3]. The intensity of Raman phonon modes increased with the increase of T_b up to 70 ^{o}C, which indicated that, an improvement in the crystallinity of the films, and then slightly decreased. This shows poor crystallinity of the layers when the T_b exceeds the favourable temperature. No other peaks were observed in the spectra related to other phases like SnS_2 and Sn_2S_3 or other impurities. Therefore, the as-grown SnS films had only single phase and the results correlated with XRD studies. The present developed SnS films have potential application in the fabrication of solar cells.

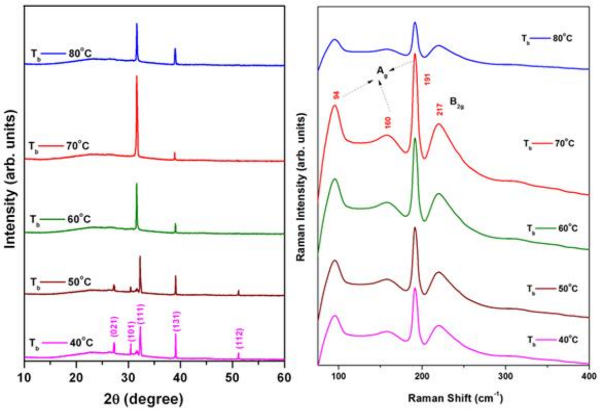

Fig. 1. XRD and Raman profiles of SnS films

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