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Characterization of Indium doped Tin Selenide ($In:Sn_xSe_y$) Thin Films for Phase Change Memory Application

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Tin Selenide phase change resistor has demonstrated desirable characteristics as a resistive contrast chalcogenide phase change memory material. The high crystallization temperature and high resistivity contrast between amorphous and crystalline qualify SnSe as suitable for phase change memory. Studies on stoichiometric $SnSe_4$ have shown high crystallization temperature and electrical resistivity comparable to conventional $Ge_2\ Sb_2Te_5$ with switching dynamic range of a factor of 10^2. Indium doping has shown increase in data retention in $Ge_2\ Sb_2Te_5$ These findings have attracted more research into various ways of improving Tin Selenide to be optimized as phase change memory material. Research has shown that growth condition affects properties and quality of thin films. This study seeks to investigate the influence of indium doping on structure, optical and electrical properties of a single source evaporated Sn_xSe_y thin films for phase change memory use. Dopants have shown to modify crystallization rates and control material flow in phase change layers. The $In:Sn_xSe_y$ alloy will be synthesis by melt quench method. Indium doping will be done by adding 1%, 2% and 3% Indium by mass into the Tin and Selenium mixture. The films will then be deposited by single source thermal evaporation at 10^{-6} Mbar pressure using Edward Auto 306 RF/DC Magnetron evaporation chamber onto clean glass substrate. Optical measurements will be done using spectrophotometer 3700 DUV. Current voltage characteristics to determine sheet resistivity will be done using Keithly 2400 source meter while structure elucidation will be done using X- Ray diffraction Diffractometer.