National Institute of Technology Rourkela

Synopsis Seminar

Seminar Title	: Modulation of electronic properties of tellurized molybdenum thin films for photodetector applications
Speaker	: Anurag Gartia (Rollno : 519ph6013)
Supervisor	: Jyoti Prakash Kar
Venue	: Seminar room (MC 126)
Date and Time	: 17 Jul 2025 (11.00 AM)
Abstract	: The growing demand for photodetectors has drawn attention for the growth of semiconducting metal chalcogenide films due to their tuneable bandgap and optoelectronic properties. In this work, $MoTe_2$ thin films were fabricated using physical vapour deposition system with a face-to-face Mo&ndashTe arrangement on silicon substrates in horizontal furnace. Post-deposition structural, and electronic behaviour were carried out with process parameters. XRD and Raman spectroscopy were employed to analyse the structural properties of the $MoTe_2$ thin film. Electrical performance was studied using current-voltage (I&ndashV), current-time (I&ndasht) and Hall effect measurements systems. The correlation between growth parameters and electronic behavior has been established. The films, grown at 600°C with a process duration of 15 minutes, are found to be optimal growth parameter. Thereafter, $MoTe_2$ films was treated with bipyridinium dichloride and copper chloride to modulate the p-type and n-type behaviors with dopant concentration and post-annealing temperature. Various device configurations including resistive photoconductor, heterojunctions, homojunctions, schottky junctions and stack layers were fabricated to evaluate the IR response of $MoTe_2$ under 850 nm, 940 nm, 1060 nm, 1300 nm and 1550 nm illumination. Among these, The $MoS_2/MoTe_2$ stack layers has shown responsivity of 1728 mA/W and a specific detectivity of 6.52×10^{11} cm.$Hz^{1/2}$.W^{-1}. $MoTe_2$ photoconductors recorded the fastest switching response, with rise and fall times of 0.56s and 0.63s, respectively. Stacked layers like $rGO/MoTe_2$ and $MoS_2/MoTe_2$ enhance IR detection by improving interface quality, passivating defects, enabling efficient carrier separation, and facilitating faster, stronger photocurrent through built-in electric fields and type-II band alignment. Notably, tellurization of sputtered Mo films has shown enhanced IR detection performance at 1060 nm, highlighting potential application in next-generation infrared detectors.