National Institute of Technology Rourkela

Defence Seminar

Seminar Title	: Facile low temperature synthesis of bismuth molybdate (Bi2MoO6) based heterostructure materials for photocatalytic micropollutant remediation and reduction reactions
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Venue	: Seminar Hall, Chemistry Department
Date and Time	: 07 Mar 2025 (10.30 AM)
Abstract	: Rational design of semiconductor nano-heterostructure photocatalysts with broad spectrum UV-Vis response and enhanced optoelectronic features is a promising approach with potential application in waste water remediation and activation of atmospheric molecules to useful chemicals. In this research work, a series of visible light active heterostructure materials were designed by integrating bismuth molybdate (Bi_2MoO_6) with metal vanadates ($BiVO_4$, $InVO_4$, $CeVO_4$) and metal ferrite ($NiFe_2O_4$, $CaFe_2O_4$) semiconductors. Initially, morphology-controlled synthesis of Bi_2MoO_6 is accomplished under reflux condition in a simple oil bath set up. The synthesis process is optimized by using different salt precursors, reaction duration, phase stabilizing agent and reaction media to obtain nanoplate as well as nanorod morphologies. The binary/ternary heterostructure materials were subsequently prepared by employing in situ synthesis strategies under mild reaction conditions. A comprehensive characterization of the synthesized materials was carried out by using different structural, spectroscopic, microscopic and photo-electrochemical techniques to understand their physicochemical properties. The defect enriched nano-heterostructure materials exhibited improved optoelectronic features, enhanced reactive radical generation ability and higher redox potential of e^--h^+ pairs in comparison to the pure semiconductors. The photocatalytic efficacy of the heterojunction materials has been demonstrated for complete mineralization of bisphenol A and ciprofloxacin from aqueous sources, green H_2 production by water splitting reaction as well as photo-reduction of O_2 and N_2 to H_2O_2 and NH_3. The charge mobilization mechanism in the heterostructure materials and the radical pathway for the photocatalyzed reactions have been elucidated by performing comprehensive band position analysis and radical trapping studies. The detailed results obtained from these studies and major conclusions drawn based on experimental investigations will be presented in this seminar