Seminar

Institute for Plasma Research

Title : Designing of metal molybdates/chalcogenides and graphene-based nanocatalysts for the advancement of sensing and overall water splitting applications

Speaker: Dr. Gajendar Singh
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Date : 8th July 2022 (Friday)

Time : 03:30 PM

Venue : Online- Join the talk:
https://lobby.ipr.res.in/Dr.GajendarSingh_PDFTalk

Abstract: Recently, metal molybdates (MBs) have attracted the keen interest of researchers for their fascinating properties in optics, electrochemistry, and photo electrochemistry. Here, we have prepared MBs with unique morphology, smaller size, and controlled homogeneity. The crystallographic analysis, surface properties, morphology, topography, and surface functionalities have been investigated through XRD, XPS, FE-SEM, HR-TEM, Raman, and FT-IR etc. analytic techniques. The enzymatic and electrochemical properties of MBs and their nanocomposites with graphene (GO and rGO) have been investigated using UV/Vis. spectroscopy, and SECM (CHI 920D) electrochemical work station. The stable redox behaviour of MBs/rGO nanocomposites make them effective for electrochemical sensing applications. MBs/rGO nanocomposites have been employed for the trace amount detection of metal ions, biological, and pharmaceutical samples. The practicality of prepared nanocomposites has been validated through real samples analysis.

In the present project, low-cost transition metal and chalcogenides based 2D nanostructures using non-toxic chemicals and reagents are proposed to be developed. Further, 2D/2D heterostructures will be prepared using the other 2D materials Graphene and, Borophene that could boost the electrochemical water splitting behavior of parent 2D nanostructures. Graphene, Borophene, and their oxygenated form are sheet like 2D materials with high surface area, active sites, and electronic conductivity. If these are hybridized with metal dichalcogenides 2D nanostructures, can (1) enhance the charge transfer kinetics; (2) improve the catalytic performance due to the synergistic interaction at the interface; (3) overturn the catalyst bleaching for long time catalytic action. Further, the electrochemical properties of 2D/2D heterostructures will be investigated through cyclic voltammetry (CV), Mott-Schottky, and electrochemical impedance spectroscopy (EIS) analysis. The overall water splitting, and stability analysis will be investigated using linear sweep voltammetry (LSV), Tafel plots, and chronoamperometry analysis. These materials could replace Pt and RuO2/IrO2 based catalysts and could be next generation electrocatalysts for overall water splitting applications.

Keywords: Electrocatalyst, sensing, water splitting, 2D/2D heterostructures, graphene.