National Institute of Technology Rourkela

Synopsis Seminar

Seminar Title	: Architectural Design of Cu-MOF Based and its Derived Bimetal-Based Nanocomposites for Sensing of Toxic Chemicals and Harmful Gases
Speaker	: Shital Jyotsna Sahoo (Rollno : 519cy2016)
Supervisor	: Prof. Priyabrat Dash
Venue	: Seminar Hall, Department of Chemistry
Date and Time	: 11 Dec 2024 (11.00 Am)
Abstract	: Metal-organic framework (MOF) structures are crucial in materials science owing to their high tunability, formed by combining different metal and organic moieties. These features make them ideal candidates for use in sensors for environmental monitoring. The sensing activity and stability of these materials can be enhanced by decorating them with bimetallic nanoparticles and modifying them with reduced graphene oxide (rGO) supports. Another effective approach for enhancing the sensing activities are to derive morphology and composition-tuned bimetal oxides. This consequently facilitates the development of innovative materials with encouraging properties. Keeping this in mind, this thesis is focused on two major parts. The first major part involves electrochemical sensing of toxic analytes. In the first project, I demonstrated the synthesis of NiCo bimetallic nanoparticle decorated Cu-MOF modified rGO nanocomposite for electrochemical sensing of triclosan (Chapter 2, ***J. Electroanal. Chem.*** 2023, 943, 117589). To reduce the complexity in synthesis, a one-step synthesis of CuNi-bimetallic MOF wrapped N-3DrGO was showcased for atrazine sensing (Chapter 3, *Manuscript Submitted*). Later on, to overcome the moisture instability and increase the thermal stability while retaining the structure, morphology, and properties of MOF, in the third objective various cation substituted Cu-based bimetallic MOF- derived bimetallic oxides (CuO/NiO, CuO/ZnO, CuO/Mn_2O_3) modified 3DrGO nanocomposite was developed for the sensing of clioquinol (Chapter 4, *Manuscript to be submitted*). Another major part of the thesis involves gas sensing that also includes three major chapters. In the first chapter of gas sensing, a comparison study was conducted between traditional and MOF-mediated synthesis of CuO/NiO bimetal alloy oxides decorated on rGO for NO_2 sensing. (Chapter 5, ***ACS Appl. Electron. Mater.*** 2024, 6, 2349). Later, the efficiency of the core-shell structure with the varying metal ions of the shell (Zn, Ni, Co) modified with N-3DrGO was carried out for room temperature methane sensing. (Chapter 6, *Manuscript Submitted*). The MOF-derived CuO@Co_3O_4 showed the highest sensing performance. Continuing in this direction, in the last chapter, interest was given in the synthesis of morphology varied core of CuO@Co_3O_4 oxide (from cube to sphere to octahedron) for room temperature ultralow level ammonia sensing. (Chapter 7, *Manuscript to be submitted*). The materials discussed in this thesis have demonstrated better sensitivity, selectivity, stability, and efficiency, making them a valuable system for the aforementioned applications that hold considerable environmental importance.