AOPs PhD School

PhD Candidate Profile

Name:
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Research Group:
Nanotechnology & Bio-Engineering Research Group

Research Centre:
The Centre for Precision Engineering, Materials & Manufacturing research (The PEM Centre)

Department/School:
Department of Environmental Science, School of Science

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Funding body:
IT Sligo President's Bursary

Area (field) of study:
2-D Semiconductor nanomaterials

Thesis Title:
Antimicrobial and Cytotoxicity analysis of 2D semiconductor nanomaterials

Abstract:
2-D nanomaterials are the new low dimensional class of materials, which has attracted reasonable attention worldwide. The discovery of graphene brought the concept of isolation of several other 2D materials like metal nitrides and carbides from bulk. The exfoliation of bulk material to few or even single layer by chemical and the mechanical route has prompted to a deeper quest for alternative methods to manipulate and optimise over a range of desired properties. The isolated 2D materials exhibits unique features such as good electrical conductivity, appreciable thermal conductivity (5000 $Wm^{-1}K^{-1}$), large theoretical surface area (over 2000 m^2/g), high mechanical strength (almost 2 TPa), charge transfer interactions with molecules etc. Their application extends from the use in supercapacitors, photo-conducting cells, p–n junctions, as low-dimensional magneto-optical nanostructures, in a biomedical application such as drug delivery, biosensors, and diagnostics. The growing concern over the use of nanomaterials for consumer products has prompted researchers to look upon the biocompatibility of the materials. Moreover, there lies significant deficit in understanding of cytotoxicity and biocompatibility of 2-D materials.

Therefore, in this work we intend to look upon the various environmental and energy applications like antimicrobial, cytotoxicity, photocatalytic activity etc. of the 2-D nanomaterials.

The objectives of the work are:

- Parametric optimisation of the synthesis conditions of 2-D nanostructures
- Characterisation of the optimised 2-D nanostructures
- Antimicrobial, Cytotoxicity and photocatalytic activity of various 2-D nanostructures

Collaborations:

- University of Surrey
- University of Manchester
- CRANN (The Centre for Research on Adaptive Nanostructures and Nanodevices), Trinity College Dublin.
- CÚRAM (Centre for Research in Medical Devices), Galway.
- Kastus Ltd, Dublin.

Publications:

1. Bhamore, J. R., **Ganguly, P.**, & Kailasa, S. K. (2016). Molecular assembly of 3-mercaptopropinonic acid and guanidine acetic acid on silver nanoparticles for selective colorimetric detection of triazophos in water and food samples. **Sensors and Actuators B: Chemical**, **ELSEVIER**, *233*, 486-495.

2. Panneri, S., **Ganguly, P.**, Nair, B. N., Mohamed, A. A. P., Warrier, K. G., & Hareesh, U. N. (2016). Copyrolysed C_3N_4-Ag/ZnO Ternary Heterostructure Systems for Enhanced Adsorption and Photocatalytic Degradation of Tetracycline. **European Journal of Inorganic Chemistry**, **WILEY** 2016(31), 5068-5076.

3. Suyana, P., **Ganguly, P.**, Nair, B. N., Mohamed, A. P., Warrier, K. G. K., & Hareesh, U. S. (2017). Co_3O_4–C_3N_4 p–n nano-heterojunctions for the simultaneous degradation of a mixture of pollutants under solar irradiation. **Environmental Science: Nano, RSC**.

4. Panneri, S., **Ganguly, P.**, Mohan, M., Nair, B. N., Mohamed, A. A. P., Warrier, K. G. K., & Hareesh, U. S. (2016). Photo-regenerable, bifunctional granules of carbon doped g- C_3N_4 as adsorptive photocatalyst for the efficient removal of tetracycline antibiotic. **ACS Sustainable Chemistry & Engineering.**

5. Panneri, S., **Ganguly, P**., Nair, B. N., Mohamed, A. A. P., Warrier, K. G. K., & Hareesh, U. N. S. (2017). Role of precursors on the photophysical properties of carbon nitride and its application for antibiotic degradation. **Environmental Science and Pollution Research**, 1-10.

6. Panneri, S., Thomas, M., **Ganguly, P.**, Mohan, M., Nair, B. N., Mohamed, A. A. P., Warrier, K. G. K., & Hareesh, U. S. (2017). C_3N_4 Anchored ZIF 8 Composites: Photo-regenerable, high capacity sorbents as adsorptive photocatalysts for the effective removal of tetracycline from water. **Catalysis Science and Technology, RSC** DOI: 10.1039/C7CY00348J.

Presentations:

N/A