Subhra Jana

DST Inspire Faculty
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Subhra Jana is currently working as a DST INSPIRE faculty at S. N. Bose National Centre for Basic Sciences. She did her postdoctoral research work from Pennsylvania State University, University Park and Ph.D. from Indian Institute of Technology Kharagpur. She was awarded SERB Women Excellence Award and Young Associate of Indian Academy of Sciences, Bangalore. Her multi-disciplinary research involves solution phase synthesis and potential application of alloys, intermetallics and hybrid nanocomposites.

Supervision of Research / Students

Ph.D. Students

1. Sankar Das
2. Arnab Samanta

Projects of M.Sc./ M.Tech./ B.Tech./ Post B.Sc. students

1. C.V.K.L Ramya

Publications in Journals

1. S. Das, **S. Jana**; *A tubular Nanoreactor Directing the Formation of In Situ Iron Oxide Nanorods with Superior Photocatalytic Activity*; Environmental Science: Nano; 2017; **4;** 596–603.
2. **S. Jana,** A. V. Kondakova, S. N. Shevchenko, E. V. Sheval, K. A. Gonchar, V. U. Timoshenko, A. N. Vasilev; *Halloysite Nanotubes with Immobilized Silver Nanoparticles for Anti-Bacterial Application;* Colloids and Surfaces B: Biointerfaces; 2017; **151;** 249-254.
3. G. Dutta Banik, A. De, S. Som, **S. Jana,** S. B. Daschakraborty, S. Chaudhuri, M. Pradhan; Hydrogen Sulphide in Exhaled Breath: *A Potential Biomarker for Small Intestinal Bacterial Overgrowth in IBS;* Journal of Breath Research; 2016; **10;** 026010.

Other Publications

1. S. Jana, Moisture Induced Isotopic Carbon Dioxide Trapping from Ambient Air Using Low-Cost Clay Based Nanocomposites, Proc. of the Intl. Conf. on Nanotechnology for Better Living, 2016, 3, 302.

Lectures Delivered

1. International Conference on Advances in Nanotechnology (ICAN 2017), January 9-13, 2017 held at Assam Don Bosco University (Jointly organized by Assam Don Bosco University and Sustainable Nanotechnology Organization, USA).
2. Networking-Cum-Discussion Meeting, January 16-17, 2017 held at KIIT University, Bhubaneswar.
3. 82nd Annual Meeting of Indian Academy of Sciences, Bangalore, November 4-6, 2016 held at IISER Bhopal.
4. International Conference on Nanotechnology for Better Living (ICNBL 2016), May 25-29, 2016 held at NIT Srinagar (Joint initiative of IIT Kanpur and NIT Srinagar).

Membership of Committees

External Committee

Editorial Board Member of Scientific Reports (*Nature Publishing Group*) from 2015 onward

Internal Committee

Member of Seminar and Colloquia Programme (SCOLP) committees; Member of interview committees; Member of organizing committee of Bose Fest; Member of Local Management Committee (LMC) of Technical Research Centre, SNBNCBS

Patent/s submitted / granted

Title: A Method to Direct the Growth and Formation of Nanorods, Inventors: Sankar Das and Subhra Jana

Awards / Recognitions

1. SERB Women Excellence Award, 2017.
2. Young Associate of Indian Academy of Sciences, Bangalore, 2015-2018.

Fellow / Member of Professional Body

1. Life Member of Chemical Research Society of India
2. Life Member of Materials Research Society of India

Sponsored Projects

1. SERB Women Excellence Research Grant, DST, India, Sanctioned for 3 years.
2. Extramural Research Grant as a PI funded by Nano Mission, DST, India from June 2016-June 2019.
3. Technical Research Centre (TRC) funded by DST, India from January 2016-December 2020. (One of the Activity Leaders, PIs)

4. INSPIRE Research Grant funded by DST, India from November 2012-October 2017.

Collaborations including publications (Sl. No. of paper/s listed in 'Publications in Journals' jointly published with collaborators)

International

1. Sl. No. 2

Member of Editorial Board

1. Editorial Board Member of Scientific Reports (*Nature Publishing Group*) from 2015 onward.

Significant research output / development during last one year

General research areas and problems worked on

Experimental Materials Chemistry

- Solution Phase Conversion of Nanoscale Metals into Intermetallics: Efficient Catalysts for Chemoselective Organic Transformations
- Synthesis of Hybrid Nanocomposites for Use as Efficient Carbon Dioxide Capture Materials

Interesting results obtained

1. We have demonstrated the use of inner lumen of clay nanotubes as nanoconfined reactor for the synthesis of nanoscale inorganic materials. Selective modification of the lumen using a chelating ligand facilitates the adsorption of iron and subsequently formation of nanoscale iron oxide within the lumen of the clay nanotubes (Figure 1). Lumen modification followed by the formation of iron oxide in the clay nanotubes has been evidenced by several physical methods, authenticating the presence of chelating ligand as well as formation of α-Fe_2O_3 nanorods inside the lumen and thus originating α-Fe_2O_3 nanocomposite that exhibits solar light induced enhanced photocatalytic activity. This study represents the first demonstration of the selective modification of clay lumen using a chelating ligand to direct the in situ synthesis of iron oxide nanorods. Thus, the selective lumen modification under mild condition to produce novel inorganic-organic hybrid nanocomposites may open up a new direction in the frontier area of nanoconfined reactions and hence may impart a broader impact in the field of catalysis and environmental remediation.

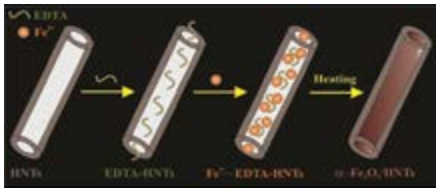

Figure 1. Schematic illustration of clay lumen (HNTs) modification with EDTA to entrap iron(III) via the formation of iron-EDTA complex followed by the decomposition to produce iron oxide nanorods within the lumen and subsequently achieved α-Fe_2O_3 nanocomposites.

2. Halloysite nanotubes (HNTs) with immobilized silver (Ag) nanoparticles (NPs) were prepared by methods of wet chemistry and were characterized by using the transmission electron microscopy, x-ray diffraction, optical spectroscopy and experiments with *E. coli* bacteria *in-vitro*. It was found that Ag NPs with almost perfect crystalline structure and sizes from ~ 9 nm were mainly attached over the external surface of HNTs. The optical absorption measurement revealed a broad plasmonic resonance in the region of 400-600 nm for HNTs with Ag NPs (Figure 2). The later samples exhibit bactericidal effect, which is more pronounced under illumination. A role of the plasmonic excitation of Ag NPs for their bioactive properties is discussed. The obtained results show that Ag NPs–decorated HNTs are promising agents for antibacterial treatments of liquids and surfaces stimulated by visible light exposure.

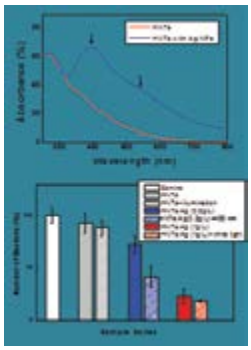

Figure 2. (A) Absorption spectra of the bare HNTs (red line) and those with Ag NPs (blue line) deposited on quartz substrate. Vertical arrows indicate features of the plasmon resonance in Ag NPs. (B) Relative number of *E. coli* bacteria after incubation without (control) and with bare HNTs (1 g/L) in darkness (grey bars) and under illumination (pattern grey bars) as well as with HNTs (0.2 g/L) covered by Ag NPs (blue bars) in darkness and under illumination at 488 nm (blue pattern bars), and HNTs (1 g/L) covered by Ag NPs (red bars) in darkness and under illumination with white light (red pattern bars).

Proposed research activities for the coming year

Proposed research plan has been summarized below:

- Using solution chemistry route fabrication of inorganic-organic hybrid nanocomposites for environmental remediation.
- Synthesis of size- and shape-tunable nanoscale alloys for surface-enhanced Raman spectroscopy.
- Utilize these nanocomposites and nanoscale alloys as heterogeneous catalysts for chemical and photochemical reactions.

Any other matter

1. Reviewer of several ACS, RSC, Elsevier and Wiley Journals.