Dr. Narayan Chandra Das

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ACADEMIC QUALIFICATION

S.No.	Degree	Year	Subject	University/Institution
1.	B. Sc.	1992	Chemistry (Major)	Calcutta University
2.	B. Tech.	1996	Polymer Science and Technology	Calcutta University
3.	M. Tech.	1998	Rubber Technology	IIT, Kharagpur
4.	Ph. D.	2002	Rubber Technology	IIT, Kharagpur

WORK EXPERIENCE (IN CHRONOLOGICAL ORDER).

S.No.	Positions held	Name of the Institute	From	To
1.	Lecturer	Thaper University, Punjab, India	02/05/2001	22/04/2002
2.	Post-doctoral	K U Leuven, Belgium	22/04/2002	17/07/2002
2.	Part time lecturer	Hiroshima University, Japan	22/07/2002	21/07/2004
3.	Postdoctoral Researcher	Michigan Technological University, USA	05/05/2005	14/08/2006
4.	Research Associate	SUNY Binghamton, New York, USA	15/08/2006	04/02/2009
5.	Research Professor	Indiana University, Bloomington, USA	05/02/2009	24/06/2013
6.	Visiting Professor	IIT Kharagpur, India	07/07/2013	04/02/2015
7.	Associate Professor	IIT Kharagpur, India	05/02/2015	21/12/2022
8.	Professor	IIT Kharagpur, India	22/12/2022	Till to date

PROFESSIONAL RECOGNITION/ AWARD/ PRIZE/FELLOWSHIP RECEIVED

S.No	Name of Award	Awarding Agency	Year
1.	COE Research Fellowship	JAPAN	2002
2.	Early career award	NSF, USA	2010
3.	Early career award	SERB, DST, India	2016
4.	Faculty Excellence Award	IIT Kharagpur	2019
5.	Top cited author award	Institute of Physics (IOP)	2019
6.	Top Cited author award (Two)	Royal Society of Chemistry (RSC)	2019
7.	Faculty Researchers World Top 2% Scientists	Stanford University, USA	2019
8.	Top Cited Author Award	American Chemical Society (ACS), USA	2022
9.	Faculty Excellence Award	IIT Kharagpur	2022

PhD THESIS AND SUPERVISORS:
Conductive polymer and polymer composites for microwave and electronics applications:
Supervisors: Prof. T. K. Chaki, Rubber Technology Centre, and Prof. A. Chakraborty, Electronics and Electrical Communication Engineering, Indian Institute of Technology Kharagpur; Year award: 2002

CURRENT RESEARCH INTERESTS
Polymer nanocomposites; thermoplastics elastomers for specialty applications; conductive polymer and nanocomposites; smart fabrics for EMI shielding, and energy applications; nanomaterials, graphene & decorated graphene; conductive hydrogel; polymers for medical applications; antipathogen coating materials; recycle of waste rubber; polymeric membrane; food packaging; activated carbon for filtration like water, air, etc.; green rubber composites; rheology and processing of polymer and polymer blends.

PROFESSIONAL RESEARCH AND WORKING EXPERIENCE

Indian Institute of Technology, Kharagpur Dec. 2022 – till to date
Professor, **Rubber Technology Centre,**
- Recycle of waste rubber and plastics: Recycle of carbon black and extraction of oil.
- Synthesis graphene, nanoparticles decorated graphene and rGO and their characterization.
- Polymer & novel thermoplastics elastomers and its applications nanocomposites for membrane, food packaging and microwave (EMI) applications.
- Smart conductive textile materials, antipathogen and anti-fouling coated fabric materials.
- Green synthesis and characterization of carbon dots: sensor and medical applications.
- Small angle X-ray/neutron scattering (SAXS/SANS) studies on polymeric, biomaterials and nano materials.

Indian Institute of Technology, Kharagpur Feb. 2015 – Dec. 2022
Associate Professor, **Rubber Technology Centre,**
- Synthesis graphene, nanoparticles decorated graphene and rGO and their characterization
- Polymer, novel thermoplastics elastomers nanocomposites for membrane, food packaging and microwave (EMI) applications.
- Smart conductive textile materials, antipathogen and anti-fouling coated fabric materials.
- Green synthesis and characterization of carbon dots: sensor and medical applications.
- Recycle of waste rubber: Recycle of carbon black and extraction of oil.
- Hydrogel and conductive hydrogel for drug delivery.

Indian Institute of Technology, Kharagpur July. 2013 – Jan. 2015
Visiting Professor, **Rubber Technology Centre,**
- Light weight and flexible polymeric nanocomposites for membrane, food packaging and microwave (EMI) applications.
- Small angle X-ray/neutron scattering (SAXS/SANS) studies on polymeric, biomaterials and nano materials.

Indiana University, Bloomington, USA Feb. 2009 – Jun. 2013
Research Professor, **Centre for the Exploration of Energy and Matter,**
- Small angle X-ray and neutron scattering (SAXS& SANS) studies of polymer nanocomposites.
- Oriented polymer crystallization template into vertically aligned carbon nanotubes arrays.
- Structural characterization of high concentrated micelles and biomolecules by SANS and SAXS

University of New York, Binghamton, USA Sept. 2006 - Jan. 2009
Research Associate, Department of Mechanical Engineering
- Synthesis, processing and applications of carbon nanotubes (CNTs), metal oxide nanoparticles, and nanorods; explore the self-assembly of nano-objects in polymers.
- Synthesize and characterization of CNTs/polymer composites through in-situ polymerization.
- Homogeneous and self-seeding crystallization of polymer and polymer blends.

Michigan Technological University, USA May 2005 – Aug. 2006
Postdoctoral Research Fellow, Materials Science and Engineering

- Study the phase separation behavior of polymer blends and crystallization using SANS and USANS, differential scanning calorimetry, optical microscopy and AFM. Investigate the time evolution of morphology and structures development in the blends.
- Rheology and morphology of conjugated polymers in solutions and melt.

Hiroshima University, Japan July 2002 – July 2004
Lecturer, Soft Materials Physics Group, Faculty of Integrates Arts and Sciences

- Investigation of early stage crystallization and structure formation of polyolefin using time-resolved simultaneous synchrotron radiation small and wide angle X-ray scattering (SAXS and WAXD) and optical microscopy. Investigated time evolution of size distribution of nucleus during induction period of polymer crystallization from the melt.
- Investigated nucleation and growth mechanism of polymer crystallization under shear flow using optical microscopy, SAXS and WAXD.

Katholieke University Leuven, Belgium April 2002 – July 2002
Postdoctoral Researcher, Department of Chemical Engineering

- Investigated on microstructure development and morphology of immiscible polymer blends during processing from rheological properties using different techniques like dynamic stress control Rheometer (DSR), Rheometer RMS800, Rheometer Ares-9, Rheo-optics and SALS etc.

Thapar University, India June 2001 – April 2002
Lecturer/Research Engineer, Department of Chemical Engineering & Division of Materials Science

- Developed a high voltage lighting arrestors compounds based on ethylene propylene diene (EPDM) and silicone rubber blends
- Developed oil resistance sealing compound for high temperature transformer applications

EXPERIMENTAL EXPERTISE

Neutron scattering [small and ultra small angle neutron scattering (SANS & USANS), synchrotron radiation and laboratory facilities X-ray scattering [small and wide angle X-ray scattering (SAXS & WAXS)], X-ray diffraction, chemical vapor deposition, polymer and conductive polymer synthesis, scanning electron microscopy (SEM), atomic force microscopy (AFM), optical microscopy, thin film deposition, dynamic stress control rheometer (DSR), strain control rheometer RMS800, rheometer-Ares-9, DMA, DSC, TGA, infrared spectrophotometer, HPLC, GPC, atomic absorption spectrophotometer, FT-IR, UV-Vis spectroscopy, photoluminescence spectroscopy, ESCA (XPS), TEM, scalar network analyzer, micro hardness meter (Wallace), energy dispersive spectrometer, gloss meter (Elcometer), atlas UV-CON instrument for accelerated aging test for paints and other general polymer testing machines, etc.

TEACHING EXPERIENCE (Present and Past)

a) Teaching at IIT Kharagpur, India

Polymer Rheology and Processing, Rubber compounding and Reinforcing Materials, Tyre Technology, Rubber Products and Manufacturing Technology, Adhesion Science and Technology, Physical Testing of Rubbers.Science and Technology-Rubber and Rubber-like Materials, Characterization of Rubber and Rubber like Materials,

b) Taught at Indiana University, USA

P537: Scattering theory and applications: A course on X-ray/neutron scattering of soft condensed matter, including polymer composites, polymer crystallization, polymer rheology, polymer structure and dynamics, and nano porous materials

MEMBERSHIP AND PROFESSIONAL SOCIETY ACTIVITIES

American Chemical Society, American Physical Society, American Chemical Society- Rubber Division.

RESEARCH ACTIVITIES

i. Project (ongoing & completed)

Sl. No	Title	Cost in Lakh	Start Date	End Date	Role as PI/Co-PI	Agency
1.	Formation of double percolated conductive network (DCPN) and segregated structure with ultra-low carbon nanostructure filler content in thermoplastics elastomers vulcanizates (TPVs) with improved electrically conductivity and enhanced electromagnetic interference (EMI) shielding effectiveness	54.23	04-03-22	03-3-25	PI	SERB-DST, India
2.	Formation of double network structure (DNS) in elastomer with improved mechanical and dynamic mechanical	51.37	01-01-21	31-12-24	Co-PI	SERB-DST, India
3.	Training and skill development and its evaluation for IRI members	7.22	01-01-21	31-12-23	PI	IRI, Kolkata
4.	Green synthesis and characterization of biocompatible multi-color luminescent carbon dots for bioimaging and/or sensing applications	41.48	17-01-20	16-01-23	PI	MHRD-STARS
5.	Surface Engineering of Textiles and Soft/Hard Substrates by Impregnation of Metallic Nano-particles Decorated Graphene - An Economical Method to Combat Covid-19 Pandemic	7.00	16-06-20	09-06-22	Co-PI	IITKgp
6.	Invention of smart process technology for production of valuable products including oil and carbon black from waste tire	87.99	15-01-19	14-01-22	PI	MHRD-IMPRINT-II
7.	Functional polymers via ultrasound assisted polymerization; a green technology	48.26	15-03-19	14-03-22	Co-PI	SPARC, MHRD
8.	Radiation processable hybrid polymer nanocomposites multilayer films for food packaging materials processable hybrid polymer nanocomposites multilayer films for food packaging materials	26.58	01-04-18	31-03-21	PI	BRNS, DAE, India
9.	Advanced high strength conjugated polymer based conductive fibers as a smart textile materials for space applications	26.76	25-04-16	24-04-19	PI	ISRO, India

10.	Development of light weight thermally & electrically conductive high performance microwave radiation absorbing nanowires/polymer nanocomposites materials	27.91	05-08-16	19-12-19	PI	SERB-DST, India
11.	Development of carbon driven light weight and flexible conductive rubber/rubber-like conductive composites for electromagnetic field (EMF) radiation shielding materials from mobile tower and commonly used handset	25.08	27-05-14	26-05-17	PI	ISIRD, IIT Kharagpur

ii. Ph.D/M.Tech Thesis supervision

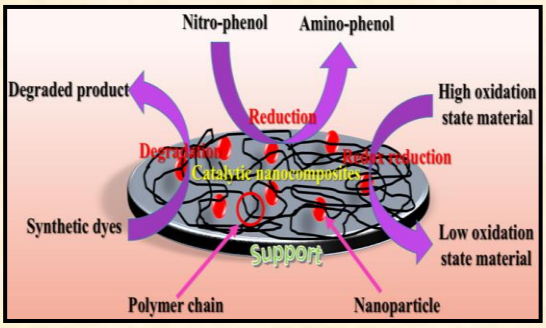
Students	**Completed (10)**		**Ongoing (14)**	
	Single	**Joint**	**Single**	**joint**
Ph.D.	6	4	6	11
M. Tech/M.S	19		3	

iii. Number of publications:

Publications	**Total**
International journals	154
Book Chapters	16
Proceeding in Symp. & Conferences	59
Book Editing	1
Patent	1 (filed)

RESEARCH ACTIVITIES

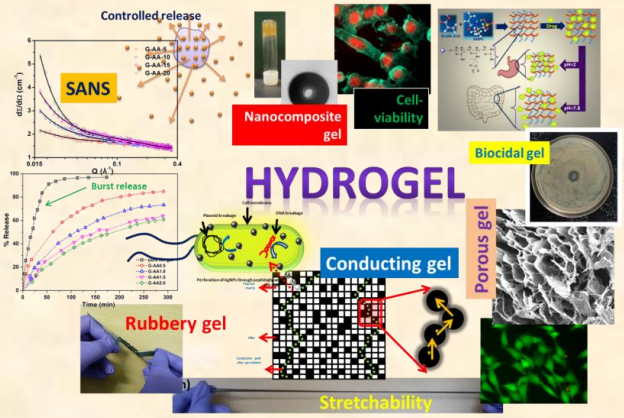
Catlytic degradtion of aromatic pollutants by polymer stabilized nobel metal nanoparticles decorated



Recently the catalysis science and technology is essential as energy and environmental problems come in to the daylight of society. Knowing surprising catalytic activity of noble metal nanoparticles researchers are motivated to tune sizes of the nanoparticles from its precursors via various chemical in a simple facile ecofriendly way. One of the major problems associated with these noble metal nanoparticles is aggregation which is less active towards catalytic application. So, synthesis of fine tuning decorated stabilized nanoparticles on different supports is now challenging task to researchers. Tuning size of noble metal nanoparticles by polymer has gain interest due to not only advantage of *in-situ* generation nanoparticles from its salt by reduction but also

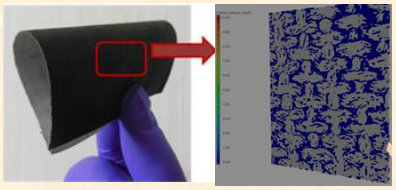
provide stabilization to nanoparticle over supports. These nanoparticles decorated catalytic nanocomposites is employed as catalytic supports for reduction of nitro-phenols, degradation of synthetic dyes and redox reduction of inorganic compounds from its higher oxidation state to lower. Hence, the fabrication of heterogeneous catalytic nanocomposites via facile cost effective ecofriendly way, which shows high catalytic activity, is the primary aim of our research.

Hydrogel & Conductive: drug delivery



The starting of the path for hydrogels were initiated dates back at 1960 when Otto Wichterle (Austria-Hungary) and Drahoslav Lím (Czechoslovakia) innovated contact lens. After that extensive research has been done through the world. Inspiring from the multifunctional activity and tremendous synthetic tunability, our laboratory synthesizes various types of hydrogels. Traditionally hydrogels are a cluster of macromolecules/supramolecules which have propensity to swell in water. As of specialty we develop semi-interpenetrating polymeric network based hydrogels (semi-IPNs) for various applications. The main focuses on the semi-IPN type hydrogel is due to their high elastic response, superior gel strength, fine tuning in the water imbibition and inter texture/morphology, loading of several analytes, ease of fabrications of hydrogel monoliths and as an obvious demand on non-cytotoxicity nature. The main applications which we study in our lab are controlled release of drugs, fertilizer delivery, nanocomposite incorporated hydrogels, toxic pollutant removal, biocompatibility, superstretchablity, biodegradable vectors for analytes, analyte diffusion modeling, catalytic activity, conducting hydrogel and antibacterial behaviors and so on.

Smart conductive fabrics

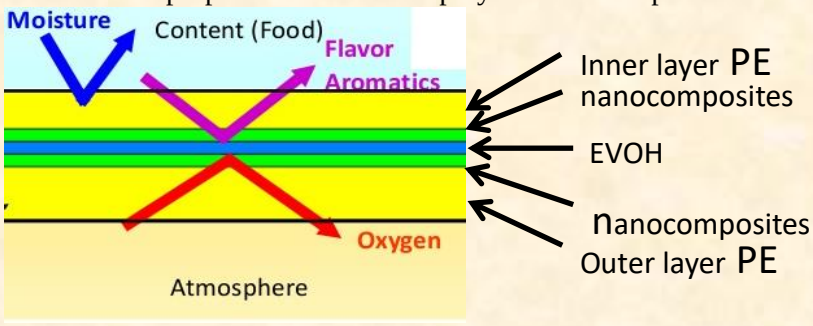


Textiles are mainly insulating material, by making the conductive textiles with the help of conductive materials such filler opened up new field of research area which are already being started from the end of twentieth century. Enhancement of electrical as well as textile properties is a challenging work because there is a huge difference in physical properties of conductive filler and textile. Textiles are inherently very soft and flexible with moderate mechanical properties in between metals and polymeric materials. So, making the conductive textiles without losing its inherent properties is a huge challenge. Moreover, with technological advantages and new application areas, creating noble demands for flexible conductive textiles for the electro-textiles (or e-textiles) or new field of interest e.g. medical textiles, sensors, EMI shielding fabric etc.

Nanocomposites for food packaging

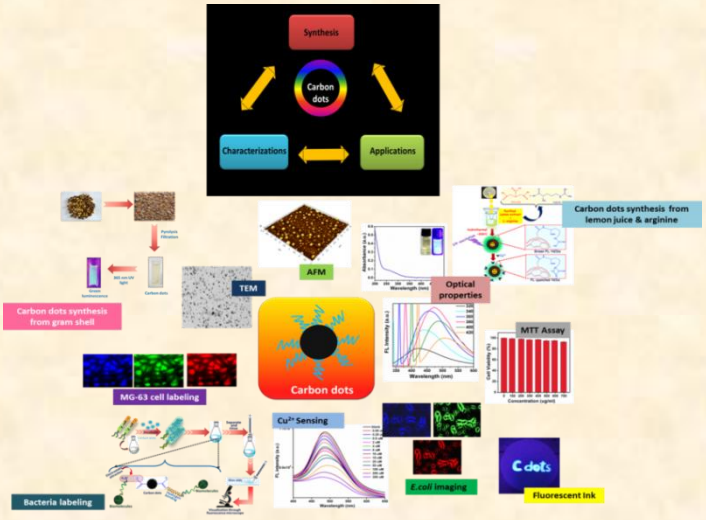
Polymer nanocomposite has attracted most attention in the food packaging industry. The high point of multidisciplinary research is required in polymer nanocomposite in food packaging to overcome the barriers like safety, technology, regulation, standardization, trained workforce, and technology transfer in order to achieve the benefit for commercial products in the global market. Polymer nanocomposite food packaging material with antimicrobial properties is particularly useful because of the high surface-to-volume ratio of nanofillers. Also, this property enhances surface reactivity of the nanosized antimicrobial agents compared to bulk counterpart, making them able to inactivate or kill microorganisms. The

performance properties such as mechanical, barrier, optical, thermal, biodegradation, antimicrobial, and other functional properties are found in polymer nanocomposites for the packaging applications.



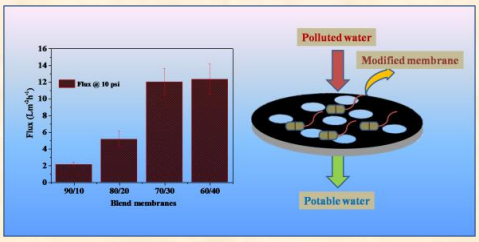
Carbon dot: Sensor, catalysis, biomedical applications

The recent era has witnessed the fast development of innovative nanotechnology in diverse region including biomedical, biological, and pharmaceutical applications. Carbon nanomaterials, including fullerenes, carbon nanotubes, graphene have gained remarkable attention owing to their unique properties and potential applications, including electrode materials, catalysis, adsorption, and gas storage among others. More recently, luminescent carbon dots, a newcomer in the domain of nanolights and nanomaterials have been studied extensively since past few years due to their excellent features. Carbon dots were discovered serendipitously by researchers purifying single-walled carbon nanotubes fabricated by arc-discharge methods.



Regarding their size, excitation dependent photoluminescence (PL) character, easy of processing and easy water dispersability, carbon dots are drawing considerable attention in sensor design, cell tracking or fluorescence based live cell assays, medical diagnosis, photocatalysis, and also being potential building blocks for nanodevices. In our laboratory, we synthesize carbon dots from natural source by simple techniques. Such green approaches have more acceptance because of their low cost productive techniques, fast synthesis, high yield, and less hazardous in purification. Our research also includes application of these carbon dots in sensor and biomedical field.

Polymeric materials for membrane



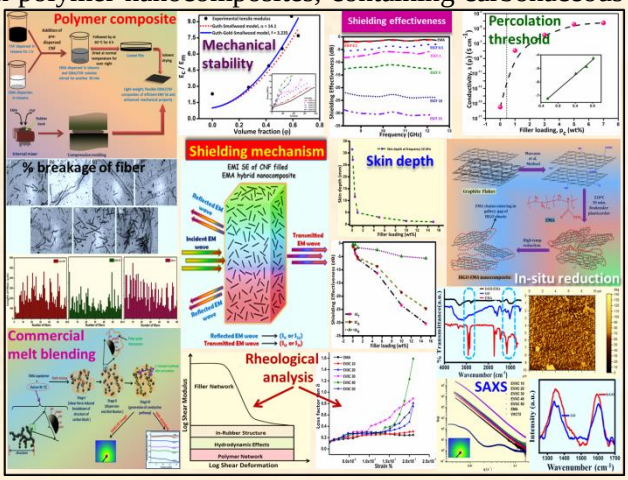
Globally, diarrhea is one of the leading causes of increased mortality among all ages, especially in India it contributes 13% of the child death under the five years of age and is the third leading cause of the childhood mortality. This condition arises from inaccessibility to the clean water. Globally access to the clean water is limited, and almost 1.2 billion people are live in the areas of physical water scarcity, and 500 million people are approaching this situation. In this scenario, water purification by polymer-based membranes is increased research interest. Polymer membrane such as PVDF is prone to bacterial fouling and research on mitigation of fouling is significantly addressed. Recently, research on graphene and other inorganic material based membrane is emerging as a low-cost membrane option with high separation efficiency as well as high permeate flux

when it is suitably modified. We focus on developing the low-cost pressure driven membranes with high separation efficiency as well as improved service life.

Microwave absorbing materials

Rapid procreation and implementation of electronic appliances and telecommunication technology emerges a new hazard known as electromagnetic interferences (EMI) which affect human life, electronic devices and medical instruments.

For effective shielding, material should contain either mobile charge carriers or electric and magnetic dipoles to interact with electric and magnetic vectors of electromagnetic radiation for resisting electromagnetic energy from any external sources. From a long period of time, metals have been used as EMI shielding materials but upcoming trend shifts towards polymer nanocomposites because of their light weight, noncorrosive nature and low price. Although polymer nanocomposites, containing carbonaceous fillers, have drawn great interest in the present science and technological field for their improved electronic and shielding effectiveness (SE) but still now they have suffered through processing difficulties, poor dispersion, high production cost. Since, properties of composites depend on several factors, such as, nature of polymer and filler, mixing technique, time and uniform dispersion of filler in polymer. Henceforth, our aim is to explore a new commercial method to develop cost effective, light weight, flexible polymeric composites with improved EMI shielding effectiveness altogether moderate mechanical and thermal stability at very low electrical percolation threshold.



Structural Analysis of Materials using SAXS

Small-angle scattering (SAS), either X-ray or neutron (SAXS or SANS) unveils invaluable information about the nanoscale size and structural profile in the bulk of systems. As such SAS has been applied to topics in materials science including ranging from soft materials, phase behavior of polymer blends, molecular self-assemblies, structure, size and size distribution of nanomaterials, size and structural characterization of micelles, gels, protein and virus, etc. One major advantage is the ability to determine a statistic ally significant bulk average particle size in the nanoscale of the order 1nm to over 100 nm with very small quantity (~60 μL) sample for the SAXS experiment. A vast number of scatters, e.g. over 10^5 can be probed in a single experiment with SAS whereas imaging such a number using microscopy would be inconceivable, even with the aid of image analysis software. Moreover, SAS can visualise the internal structure, such internal pore structure of porous materials.

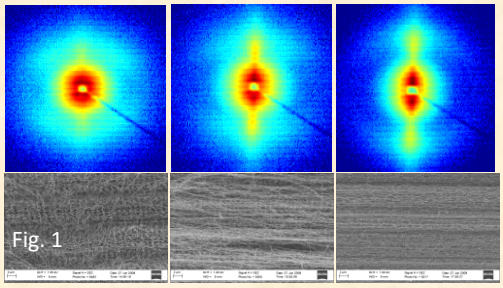
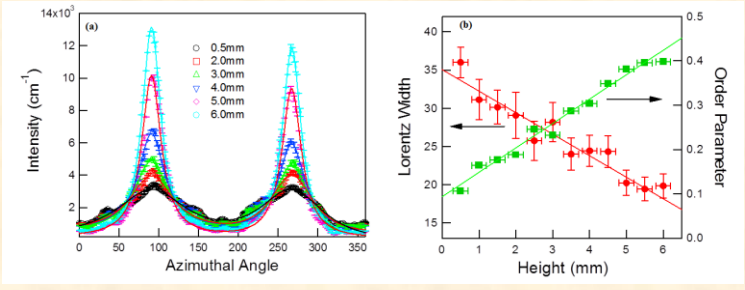
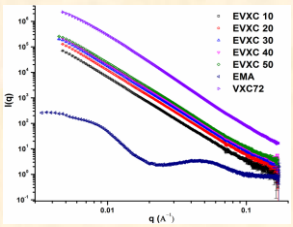


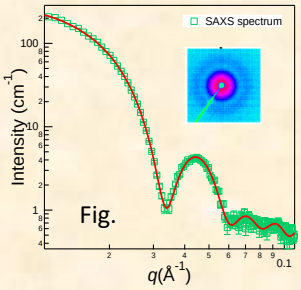
Fig. 1



This talk will be included to basic principle of SAS. We also review the recent works on characterization of polymeric materials using both X-ray and neutron scattering. 1. We will see how SAXS techniques are used to study anisotropic characteristic and structure of any materials, e.g. aligned nanotube (Fig. 1(top). Quantitative analysis of the SAXS spectrum provides differential structural parameters such as degree of alignment, inner and outer diameter of CNT. Etc Fig, 1 (bottom).



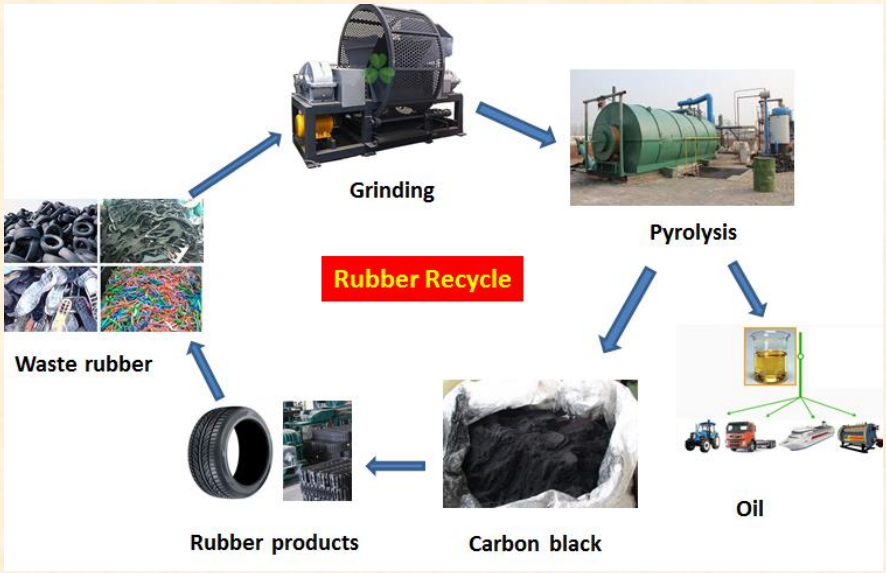
2. The application of SAS to investigate the phase behavior and crystallization of polymer. 3. The size and structure development of biomolecules like capsid protein or virus and so on will be discussed. Fig. 2 shows typical SAXS spectrum of BMV virus. Analysis gives a clear indication of size, size distribution of protein and RNA packing and their structure in the BMV and so on.



3. Filler distribution in the polymer nanocomposites can also be investigated using SAXS. Fig. 3 shows an example of SAXS. Quantitative analysis of the spectrum can be applied to get distribution characteristics of nanofillers in the polymer composites.

Recycle of Rubber waste: Recovery of carbon black and extraction of oil

The tire waste is an enormous global problem because of their non-biodegradability, their flammability and their chemical composition that leads to leaching of toxic substances into the ground on dumping and hazardous fumes on incineration. Since they are hefty and made of multiple materials, scrap tires present distinct challenges in recycling and disposal. Tires generally do not decay nearly as quickly as other waste in the landfill due to vulcanization of rubber in presence of sulphur; because of this, other material around the tire will decompose and cause the tire to rise to the surface of the landfill. we are working to invent a technology to get more advanced tire oil and carbon black with zero emission and with overcoming present drawbacks. Different recycling routes, like pyrolysis, super critical fluid extraction, devulcanization and combination of these three techniques will be investigated to convert them into oil, carbon black and other valuable products. The techniques will be optimized to pilot plant by considering yield of products, quality of products, production cost and safety parameters, global environmental emission and targeting to the ZERO EMISSION AND ZERO WASTE



Funding Agency

सत्यमेव जयते
Science and Engineering Research Board (SERB)
Department of Science and Technology (DST)
Govt. of India

BOARD OF RESEARCH IN NUCLEAR SCIENCES (BRNS)
राष्ट्र की सेवा में परमाणु
BRNS
ATOMS IN THE SERVICE OF THE NATION

सत्यमेव जयते
Government of India
Ministry of Human Resource Development

INDIAN INSTITUTE OF TECHNOLOGY KHARAGPUR
भारतीय प्रौद्योगिकी संस्थान खड़गपुर
1951
योगः कर्मसु कौशलम्

STARS
SCHEME FOR TRANSFORMATIONAL AND ADVANCED RESEARCH IN SCIENCES

PUBLICATIONS (International)

1. P. Das, A. Katheria, S. Ghosh, B. Roy, J. Nayak, K. Nath, S. Paul, **N. C. Das**, "*Self-healable and super-stretchable conductive elastomeric nanocomposites for efficient thermal management characteristics and electromagnetic interference shielding*", Synthetic Metals, 294 117304 (2023).
2. S. Paul, M. Rahaman, S. K. Ghosh, A. Katheria, T. K. Das, S. Patel, **N. C. Das**, "*Recycling of waste tire by pyrolysis to recuperate carbon black: An alternative reinforcing filler*", Journal of Material Cycles and Waste Management (2023).
3. B. Roy, S. Mahato, S. Bose, A. Ghorai, S. S. Srivastava, **N. C. Das**, S. K. Ray, "*Cu-doping induced phase transformation in CsPbI nanocrystals with enhanced structural stability and photoluminescence quantum yield*", Chemistry of Materials (2023).
4. T. Ghosh, S.Nandi, S. K. Bhattacharyya, S. K. Ghosh, M. Mandal, P. Banerji, **N. C Das**, "*Nitrogen and sulphur doped carbon dot: An excellent biocompatible candidate for in-vitro cancer cell imaging and beyond*", Environmental Research 217 (2023) 114922.
5. P. Das, A. Katheria, K. Naskar, **N. C. Das**, "*Recyclable and super-stretchable conductive elastomeric composites with a carbon nanostructure interconnected network structure for effective thermal management and excellent electromagnetic wave suppressor*", Polymer-Plastics Technology and Materials (2023).
6. T. Ghosh, R. Sahoo, S. K. Ghosh, P. Banerji, **N. C. Das**, "*Simplistic hydrothermal synthesis approach for fabricating photoluminescent carbon dots and its potential application as an efficient sensor probe for toxic lead(II) ion detection*", Front. Chem. Sci. Eng. (2023).
7. P. Panda, A. Dutta, S. Pal, D. Ganguly, S. Chattopadhyay, **N. C. Das**, R. Das, "*Strain sensing multi-stimuli responsive light emitting lanthanide-based tough and stretchable hydrogels with tunable luminescence and fast self-recovery using metal-ligand and hydrophobic interaction*", New J. Chem. (2023).
8. A. Katheria, P. Das, S. Paul, K. Nath, S. Kumar Ghosh, **N. C. Das**, "*Preferential localization of conductive filler in Ethylene-co-methyl acrylate (EMA)/Thermoplastic polyolefin (TPO) polymer blends to reduce percolation threshold and enhanced electromagnetic radiation shielding over K band region*", Polymer Composites, (2023).
9. T. K. Das, S. K. Ghosh, N. C. Das, "*Green synthesis of reduced graphene oxide/silver nanoparticles-based catalyst for degradation of wide range of organic pollutants*", Nano structures & Nano Objects (2023).
10. S. Sit, G. Chakraborty, **N. C. Das**, "*Development, characterization, and modeling of the dynamic mechanical properties of a highly flexible novel SWCNT/EMA nanocomposite*", Materials Today Communication, 34, 105172 (2023).
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2. **N. C. Das**, "*Small angle X-ray scattering technique for characterization of rubber compounds in tyre and non-tyre applications*", International Rubber Conference (IRC) 2022, Bengaluru, Karnataka, November 23-26, 2022 (**Invited Lecture**).

3. **N. C. Das**, "*Polymeric nanocomposites for radiation shielding: a major challenge to control environmental pollution and health hazards*", International Conference on Macromolecule (ICM-2021), Kottayam, Kerala, India, September 10-12, 2021 (**Plenary Lecture**).

4. **N. C. Das**, **"***Tyre Technology: Basic component, manufacturing, design & development*", Refresher Course in Chemistry, UGC-Human Resource Development Centre, Kumaun University, Nainital, February 15-28, 2021 (**Invited lecture**).

5. **N. C. Das**, "*Small angle Scattering (X-ray & Neutron) for characterization of nano-structure materials and soft materials*", Refresher Course in Chemistry, UGC-Human Resource Development Centre, Kumaun University, Nainital, February 15-28, 2021 (**Invited lecture**).

6. **N. C. Das**, "*Polymeric materials for radiation shielding: a major challenge to reduce environment pollution and protect our health*", Occupational Health & Environment Management towards Sustainable growth, Jadavpur University & Vivekananda Institute of Environment & Management, Kolkata, December 7-14, 2020 (**Invited lecture**).

7. **N. C. Das,** "*Polymeric nanocomposites/nanomaterials for electromagnetic radiation shielding: a major challenge of environment pollution to health protection*", International Conference in Nanotechnology for Better Living (ICNBAL 2019), NIT Srinagar, April 12-16, 2019 (**Keynote lecture**).

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Book Chapters

1. S. Ganguly, **N. C. Das**, *Chlorosulphonated polyethylene and its composites for electronics applications*, Flexible and Stretchable Electronics Composites, ed. by S. Thomas et al. Ch. 8, Pg. 229-259(2016), Springer, Switzerland.
2. S Ganguly, **N. C. Das,** *Rheological Properties of Polymer–Carbon Composites*, Carbon-Containing Polymer Composites, ed. by Mostafizur Rahaman, Dipak Khastgir, Ali Kanakhir Aldalbahi, Ch. 8, Pg. 271-294, (2019), Springer, Singapore.
3. K. Nath, S. K. Battacharyya, **N. C. Das**, *Biodegradable polymeric materials for EMI shielding*, Materials for potential shielding applications, ed. J. Kuruvilla, W. Runcy, G. Geo, Ch. 10, Pg.165-178 (2019), Elsevier, UK.

4. S. Ganguly, P. Das, **N. C. Das**, *Characterization tools and techniques of hydrogels*, Hydrogels Based on Natural Polymers, ed. by Yu Chen, Ch. 16, Pg.481-517 (2019), Elsevier, UK.
5. S. Remanan, **N. C. Das**, *Application of DSC to Polymeric Systems*. Polymers and Multicomponent Polymeric Systems by Jose James, Pramoda Kumari Pallathadka, Sabu Thomas, Taylor & Francis Group, Ch. 6, Pg. 153-178 (2019), CRC Press, Boca Raton, USA.
6. S. Remanan, H. Pulikkalparambil, S. M. Rangappa, S. Siengchin, J. Parameswaranpillai, **N. C. Das**, *Hydrophobic and Hydrophilic Polymer Coatings*; Polymer Coatings: Technologies and Applications, by Sanjay Mavinkere Rangappa, Jyotishkumar Parameswaranpillai, Suchart Siengchin, Ch. 13, pg. 247*268 (2020), CRC Press, Boca Raton, USA.
7. S. Remanan, S. Ghosh, T. K. Das, **N. C. Das**, A*pplications of Thermoplastics and Thermosetting Polymer Composites*, Lightweight Polymer Composites Structures: Design and Manufacturing Techniques by S. M. Rangappa, J. Parameswaranpillai, S. Siengchin, L. Kroll, Ch. 12, P. 331-357 (2020), CRC Press, Boca Raton, USA.
8. S. Remanan, **N. C. Das**, *Membrane Distillation: An Efficient Technology for Desalination*; Sustainable Technologies for Water and Wastewater Treatment, ed. N. J. Kaleekkal, P. Kumar S. Mural, S. Vigneswaran, U. Ghosh, Ch. 4, Pg. 51-70 (2021), CRC Press, Boca Raton, USA.
9. K. Nath, **N. C. Das**, EMI Shielding Studies of Carbon Nanotube-Polymer Composites. Handbook of Carbon Nanotubes by Abraham J., Thomas S., Kalarikkal N. (eds) Ch. 9 (2021), Springer, Cham.
10. T. K. Das, **N. C. Das,** *Preparation of 1D, 2D and 3D Nanomaterials for Water Treatment*, Eds. N. J. Kaleekkal, P. Kumar S. Mural, S. Vigneswaran Nano-Enabled Technologies for Water Remediation, ed., Ch. 3, (2022) Elsevier, UK
11. S. Subhadarshini, N. C. Das, *The growth of electrode materials for energy storage*; Conjugated polymers for next-generation applications, V2: Energy storage devices, (2022) Woodhead Publishing Series, Ch. 4, Pg. 115-144.
12. K. Nath, N. C. Das, *Conjugated polymer-based fibers: synthesis, properties, and applications*; Eds. V. Kumar, K. Sharma, Conjugated polymers for next generation applications, V1, (2022) Woodhead Publishing Series, Ch.1, pg. 1-38, Elsevier, UK
13. S. Hui, N. C. Das, Eds. J. Aslam, C. M. Hussain, R. Aslam, *Surface modified carbon nanotubes in Food Packaging*. Eds by. Surface modified carbon nanotubes, ACS, V2, Ch. 9, Pg. 199-233 (2022).
14. S. Hui, N. C. Das, *Graphene-elastomer nanocomposites for electromagnetic interference (EMI) shielding applications*, Ed. Graphene-Rubber Nanocomposites-Fundamentals to Applications, CRE Press, 2022.
15. S. K. Ghosh, N. C. Das, *Application of radiation curing on properties and performance of polymers and polymer composites*, Ed. Applications of high energy radiations, Springer Springer, Switzerland.
16. S. K. Ghosh, N. C. Das, *Characterization of various polymer composite sensors*, Eds. J. Parameswaranillai, Polymeric nanocomposite materials for sensor applications, Ch. 5, Pg 121, Elsevier (2023).

Book Editing

1. Polymer Nanocomposites Containing Graphene: Preparation, Properties and Applications, Edited by Dr. Mostafizur Rahaman, Dr. Lalatendu Nayak, Prof. Ibnelwaleed A. Hussein, Dr. Narayan Chandra Das, 1st Edition, Elsevier (Woodhead Publishing, USA), 2021,

List of present and past students pursuing/completed: Ph.D./M.Tech./M.Sc./ Int. M.Sc./B.Tech. Projects

Sr. N	Name	Course	Thesis title	Status	Yr.
1.	Poushali Bhawal	PhD	Electromagnetic interference shielding effectiveness of hybrid nanocomposites.	Completed	2018
2.	Subhadip Mondal	PhD	Chlorinated polyethylene based conducting nanocomposites for EMI shielding effectiveness	Completed	2018
3.	Satyajit Samantarai	PhD	Functionalization of NBR with Meta-Pentadecenyl phenol: a renewable multifunctional additives for improved processability and technical properties	Completed	2018
4.	Sayan Ganguly	PhD	Synthesis, swelling properties and stimuli responsive control release behaviour of acrylic acid based semi-IPNs	Completed	2018
5.	Poushali Das	PhD	Bio-based luminescent carbon dots for sensor and biomedical applications	Completed	2019
6.	Revathy R	PhD	Electrical conductivity and EMI shielding behavior of blend composite containing carbonaceous filler	Completed	2019
7.	Sanjay R	PhD	Biphasic polymeric blend for microfiltration membrane	Completed	2021
8.	Tushar Kanti Das	PhD	Heterogeneous polymer nanocomposites for catalytic applications	Completed	2021
9.	Sabyasachi Ghosh	PhD	Smart cotton based textile material for electromagnetic interference shielding and antibacterial application	Completed	2021
10.	Suvani Subhadarshini	PhD	Nanomaterials for supercapacitors and sensors	Completed	2022
11.	Subhashis Sit	PhD	Conductive composites and simulation	Completed	2023
12.	Swarup K. Bhattacharyya	PhD	Carbon dots and its composites for bioimaging and sensing	Ongoing	
13.	Uddhab Kalita	Ph.D	Synthesis and application of new polymers		
14.	Suman Kumar Ghosh	PhD	Multilayers films based on polymer nanocomposites for food packaging	Ongoing	
15.	Krishnendu Nath	PhD	Biodegradable conductive nanocomposites	Ongoing	
16.	Baidyanath Roy	PhD	Focus on synthesis, properties and applications of Perovskite	Ongoing	

17.	Sangit Paul	PhD	Extraction of oil and carbon black from rubber wastes	Ongoing	
18.	Ankur Katheria	PhD	Conductive thermoplastics elastomer (TPE)and thermoplastics vulcanizate (TPV)	Ongoing	
19.	Palash Das	PhD	Synthesis, characterization of nanomaterials for sensors application	Ongoing	
20.	Moumita Shee	PhD	Conductive hydrogel for biomedical applications	Ongoing	
21.	Jasomati Nayak	PhD	Hybrid nanocomposites for EMI shielding applicaiton	Ongoing	
22.	Trisita Ghosh	PhD	Synthesis, characterization of nanomaterials for sensors and bioimaging application	Ongoing	
23.	Puja Hazra	PhD	Zero dimensional nanostructure materials	Ongoing	
24.	Aparajita Pal	PhD	Nanomaterials and nanocomposites for advanced applications	Ongoing	
25.	Piyush Gupta	PhD	Polymer rheology and processing	Ongoing	
26.	Sayani Maiti	PhD	Nanomaterials and its advanced applications	Ongoing	
27.	Manjur Rahaman	PhD	Plastics recycle and waste management	Ongoing	
28.	Sreeja Nath Chowdhury	PhD	Conductive TPE and TPV	Ongoing	

Extra-Curricular Activities:

- Vice Chairman, Central Research Facility (CRF), IIT Kharagpur
- Professor-in-Charge, Small angle X-ray scattering (SAXS), Central Research Facility (CRF), IIT Kharagpur, 2014 – till to date.
- Involve induction course, 2018 & 2019.
- Faculty advisor/course coordinator, Rubber Technology, 2014 – till to date
- Research Scholar Coordinator, School of Nanoscience and Technology, 2020- till to date
- Warden, MMM hall, 2017 – 2021
- Assistant Warden, MMM hall, 2015 to 2017.
- Departmental ERP representative, Rubber Technology Centre, 2014 – 2019, 2022 to till to date
- Representative for Central Library and Departmental library in-charge, 2015 to 2022
- Coordinator, Short term course on ‘Recent advances in Rubber Technology’, 12–14, February 2019.