Samir Kumar Pal

Professor
CBMS
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Prof. Samir Kumar Pal's group is involved in the investigation of key ultrafast time scales, which are recognized to be very relevant and important in the field experimental nanoscience-technology, Biophysics and Biomedical instrumentation. They have more than 220 research papers published in various international peer-reviewed journals, 17 patent applications, 5 extramural research funding and 5 book chapters resulting more than 8366 citations, 47 h-index, 151 i10 index, to describe their activities concisely.

Supervision of Research / Students

Ph.D. Students

1. Siddhi Chaudhuri "Spectroscopic Studies On The Medicinally Important Molecules With Various Nanoparticles And Their Interaction With Different Cell Lines" University of Calcutta (2016). Completed.
2. Samim Sardar "Spectroscopic Studies on Light Harvesting Materials Toward Enhanced Solar Energy Conversion" University of Calcutta (2016). Completed.
3. Nabarun Polley "Exploration of Biomedically Relevant Spectroscopic Techniques for Potential Clinical Diagnostic and Therapeutic Procedures" University of Calcutta (2017). Completed.
4. Susobhan Chaudhury "Study on Conformation and Ultrafast Dynamics in Biomolecular Recognition with Optical Laser Spectroscopy" University of Calcutta (Submitted) (2017).
5. Prasenjit Kar, "Spectroscopic Studies on Nanomaterials for Solar Energy Harvesting Application" University of Calcutta (Ongoing).
6. Damayanti Bagchi "Spectroscopic and Microscopic Studies on Nanohybrids of Inorganic Metal-oxides with Medicinally Important Organic Ligands" University of Calcutta (Ongoing).
7. Priya Singh "Spectroscopic Studies on Structure, Function and Dynamics of Biological Macromolecules in Physiologically Relevant and Engineered Environments" University of Calcutta (Ongoing).
8. Probir Sarkar "Spectroscopic Studies on Molecules and Nanomaterials for Potential Applications in Medical Diagnosis and Environmental Pollution Monitoring" University of Calcutta (Ongoing).
9. Tuhin Maji "Combined experimental and computational investigation on optical and catalytic properties of functionalized metal oxides" University of Calcutta (Ongoing).
10. Aniruddha Adhikari "Studies on Therapeutic Potential of Various Nanomaterials and Ethnobotanical Ingredients in Preclinical Disease Model" University of Calcutta (Ongoing).
11. Jayita Patwari "Photophysical Studies on Light Harvesting Nanomaterials for Improved Solar Energy Conversion" University of Calcutta (Ongoing).
12. Soumendra Singh "Development of Spectroscopic Techniques for Potential Environmental and Biomedical Applications" University of Calcutta (Ongoing).

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

1. Sounak Banerjee (MSC Biochemistry)

Post Doctoral Research Scientists

1. Shreyasi Dutta

Teaching activities at the Centre

1. PHY 405, CB 526

Publications in Journals

1. P. Singh, S. Choudhury, S. Dutta, A. Adhikari, S. Bhattacharya, D. Pal and **S. K. Pal;** *Ultrafast Spectroscopy on DNA-Cleavage by Endonuclease in Molecular Crowding;* Int. J. Biol. Macromolecules; 2017; **103;** 395.
2. P. K. Sarkar, S. Pal, N. Polley, R. Aich, A. Adhikari, A. Halder, S. Chakrabarti, P. Chakrabarti and **S. K. Pal;** *Development and Validation of a Noncontact Spectroscopic Device for Hemoglobin Estimation at Point-of-Care;* J. Biomed. Optics; 2017; **22;** 055006.
3. P. Singh, S. Choudhury, S. Singha, Y. Jun, S. Chakraborty, J. Sengupta, R. Das, K-Han Ahn and **S. K. Pal;** *A Sensitive Fluorescent Probe for the Polar Solvation Dynamics at Protein- Surfactant Interfaces;* Phys. Chem. Chem. Phys.; 2017; **19;** 12237.
4. D. Bagchi, S. Dutta, P. Singh, S. Chaudhuri and **S. K. Pal;** *Essential Dynamics of an Effective Phototherapeutic Drug in a Nanoscopic Delivery*

Vehicle: Psoralen in Ethosomes for Biofilm Treatment; ACS Omega; 2017; **2;** 1850.

5. S. Mondal, A. Giri, Y. Zhang, **S. K. Pal,** W. Zhou and L-ping Wen; *Caspase mediated beclin-1 dependent autophagy tuning activity and apoptosis promotion by surface modified hausmannite nanoparticle;* J. Biomed. Mat. Res.: A; 2017; **105;** 1299.
6. S. Ghosh, P. Kar, N. Bhandary, S. Basu, T. Maiyalagan, S. Sardar and **S. K. Pal;** *Reduced graphene oxide supported hierarchical flower like manganese oxide as efficient electrocatalysts toward reduction and evolution of oxygen;* Int. J. Hydrogen Energy; 2017; **42;** 4111.
7. A. Adhikari, N. Polley, S. Darbar and **S. K. Pal;** *Therapeutic Potential of Surface Functionalized Mn_3O_4 Nanoparticles against Chronic Liver Diseases in Murine Model;* Materials Focus; 2017; **6;** 280.
8. Z. S. Seddigi, S. A. Ahmed, S. Sardar, N. H. Yarkandi, M. Abdulaziz and **S. K. Pal;** *Combating Fuel-driven Aqua-Pollution using "BenzoMagnets"; RSC Advances;* 2017; **7;** 12277.
9. D. Bagchi, T. K. Maji, S. Sardar, P. Lemmens, C. Bhattacharya, D. Karmakar and **S. K. Pal;** *Sensitized ZnO Nanorod assemblies to detect heavy metal contaminated phytomedicines: Spectroscopic and Simulation Studies;* Phys. Chem. Chem. Phys.; 2017; **19**; 2503.
10. J. Patwari, H. Ghadi, S. Sardar, J. Singhal, B. Tongbram, S. Shyamal, C. Bhattacharya, S. Chakrabarti and **S. K. Pal;** *Photo-induced electronic properties in single quantum well system: Effect of excitonic lifetime;* Materials Res. Express; 2017; **4;** 016301.
11. P. Kar, T. K. Maji, R. Nandi, P. Lemmens and **S. K. Pal;** *In-situ hydrothermal synthesis of Bi-$Bi_2O_2CO_3$ heterojunction photocatalyst with enhanced visible light photocatalytic activity;* Nano-Micro Letters; 2017; **9;** 18.
12. A. Adhikari, N. Polley, S. Darbar, D. Bagchi and **S. K. Pal;** *Citrate Functionalized Mn_3O_4 in Nanotherapy of Hepatic Fibrosis by Oral Administration;* Future Science (OA); 2016; **2;** FSO146.
13. M. Khatun, S. Choudhury, B. Liu, P. Lemmens, **S. K. Pal** and S. Mazumder; *Resveratrol-ZnO Nanohybrid Enhanced Anti-cancerous Effect in Ovarian Cancer Cells through ROS;* RSC Advances; 2016; **6;** 105607.
14. S. Ghosh, C-L Yu, D. Ferraro, S. Sudha, **S. K. Pal,** W. Schaefer, D. T. Gibson, and S. Ramaswamy; *Blue protein with Red Fluorescence; Proceedings of the National Academy of Sciences (PNAS, USA);* 2016; **113;** 11513.
15. P. Kar, T. K. Maji, P. K. Sarkar, S. Sardar and **S. K. Pal;** *Direct Observation of Electronic Transition-Plasmon Coupling for Enhanced Electron Injection in Dye-sensitized Solar Cells;* RSC Advances; 2016; **6;** 98753.
16. T. K. Maji, D. Bagchi, P. Kar, D. Karmakar, and **S. K. Pal;** *Enhanced Charge Separation through Modulation of Defect-state in Wide Band-gap Semiconductor for Potential Photocatalysis Application: Ultrafast Spectroscopy and Computational Studies;* J. Photochem. Photobiol. A; 2017; **332;** 391.
17. D. Bagchi, A. Ghosh, P. Singh, S. Dutta, N. Polley, I. I. Althagafi, R. S. Jassas, S. A. Ahmed and **S. K. Pal;** *Allosteric Inhibitory Molecular Recognition of a Photochromic Dye by a Digestive Enzyme: Dihydroindolizine makes Alpha-chymotrypsin Photo-responsive;* Scientific Reports (Nature Publications); 2016; **6;** 34399.
18. G. Naiya, P. Raha, M. K. Mondal, U. Pal, R. Saha, S. Choudhury, S. Batabyal, **S. K. Pal,** D. Bhattacharyya, N. C. Maiti and S. Roy; *Conformational Selection Underpins Recognition of Multiple DNA sequences by Proteins and Consequent Functional Actions;* Phys. Chem. Chem. Phys.; 2016; **18;** 21618.
19. P. Kar, S. Sardar, B. Liu, M. Sreemany, P. Lemmens, Srabanti Ghosh and **S. K. Pal;** *Facile Synthesis of Reduced Graphene Oxide-gold Nanohybrid for Potential Use in Industrial Waste-water Treatment;* Sci. Tech. Adv. Mat.; 2016; **17;** 375.
20. N. Polley, P. K. Sarkar, S. Chakrabarty, P. Lemmens, and **S. K. Pal;** *DNA Biomaterial Based Fiber Optic Sensor: Characterization and Application for Monitoring in situ Mercury Pollution;* ChemistrySelect; 2016; **1;** 2916.

Other Publications

1. D. Panda, A. Balgarkashi, S. Sardar, S. K. Pal, S. Hubbard and S. Chakrabarti, "Comparison of InAs/GaAs and InGaAs/GaAs quantum dot solar cells and effect of post-growth annealing on their optical properties" Photovoltaic Specialists Conference (PVSC), 2016 IEEE 43rd (pp. 2105-2107).

Lectures Delivered

1. Invited Speaker at National Conference on Ultrafast Sciences (UFS-2016). Held on 24-26th November 2016 at BARC Mumbai, India.
2. Invited Speaker at International Conference on Nanobiotechnology (NanoBioCon). Held on 3-5th October 2016 at MAKAUT, India.
3. Invited Speaker at Indo-Japan Discussion meeting. Held on 13-16th November 2016 at IIT-K, India.
4. Invited Speaker at National conference on Transcription Assembly 2016. Held on 8-9th November 2016 at Bose Institute, India.
5. Invited Speaker at International Conference on Advances in Biological Systems and Materials Science in NanoWorld (ABSMSNW-2017). Held on 19 23th February 2017 at IIT-Varanasi, India.

6. Invited Speaker at International Conference on Advances in Nanotechnology, iCAN 2017. Held on 9-11th January 2017 at Assam Don Bosco University, India.
7. Invited Speaker at National Symposium on Recent Advances in Chemistry & Industry 2016, with special emphasis on Pharmaceutical Industry). Held on 2-3 August 2016 at Indian Chemical Society, University of Calcutta.
8. Participant at a one-day symposium in memory of Dr. Ahmed Zewail on19th January 2017 at Califonia Institute of Technology (CALTECH), USA.

Membership of Committees

Internal Committee

Chairman, Pest Control

Patent/s submitted / granted

1. Bio-Templated Nanosensor for Mercury Detection in PPB Level. Indian Pat. Appl. (2016), 201621004916.
2. Development of DetecTEA, a low cost easy to use instrument for Quick Validation of Geographical Indication, Darjeeling Tea Indian Pat. Appl. (2017), 201721014138.

Sponsored Projects

1. Title: "Study on the role of biomolecular conformation and environmental dynamics in the process of molecular recognition with optical spectroscopy" (Award No. SB/S1/PC-011/2013), Agency: Department of Science and Technology (DST), Completed on 2016.
2. Title: "Science and application of organic ligand-transition metal oxide hybrids as new functional materials" (Award No. 2013/37P/73/BRNS) Board of Research in Nuclear sciences (BRNS), Department of Atomic Energy (DAE), Completed on 2017.
3. Title: "In(Ga)As/GaAs Quantum Dot Solar Cells" (Award No. DST/TMC/SERI/FR/117) Department of Science and Technology (DST), Approved on 2015, Continuing.
4. Title: "Development and Optimization of a Non-contact Optical Device for Online-Monitoring of Neonatal and Maternal Jaundice" Indian Council of Medical Research (ICMR), Approved on 2017, Continuing
5. Title: "Nanogels: Biophysical Characterization and Potential Biomedical Applications in Drug Delivery" Department of Biotechnology (DBT), Approved in 2015, Continuing.
6. Title: "Exploration of key photoinduced dynamics in inorganic nanohybrids for enhanced biological activities" (Award No. EMR/2016/004698), Agency: Department of Science and Technology (DST), Approved on 2017, Continuing.
7. Title: "Development of low cost, easy to use instrument for quick validation of Geographical Indication, Darjeeling Tea" (Award No. 17(404)/2016/6000), Agency: National Tea Research Foundation (NTRF), Approved on 2017, Continuing.

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

National

Sl. No. 1, 2, 3, 6, 7, 9, 10, 12, 13, 14, 16, 18, 19, 20

International

Sl. No. 3, 5, 8, 9, 11, 13, 14, 17, 19, 20

Member of Editorial Board

1. EPJ Techniques and Instrumentation (Springer),
2. J. Materials Nanoscience

Significant research output / development during last one year

General research areas and problems worked on

Ultrafast Spectroscopy of Molecules and Nanomaterials, Solar Devices, Environmental Monitoring, Food Security, Biomedical Instrumentation, Spectroscopic Techniques and Instrumentation.

Interesting results obtained

In S.N. Bose National centre our research activities are mainly in the field of experimental Biological Physics, Bio-Nano Interface, Biomimetics and biomedical instrumentation. Our activities and future direction are briefly mentioned in the following section.

Research in the field of Experimental Biophysics: Our research activities in the field of experimental Biophysics, are interdisciplinary in nature that applies the theories and methods of physics. The studies included under the umbrella of biophysics range from molecular recognition of small ligands/drugs by biological macromolecules to complicated protein-DNA, Protein-Protein complexation.

Research in the field of Experimental Nano-physics and Bio-nano Interface: The interface between the biological sciences and nanoscience constitutes one of the most interesting

and technologically promising frontiers in modern science. Our group is involved in the synthesis of various bio-nano conjugates. Selective attachment of inorganic semiconductor/metal quantum dots (QD) to various biological macromolecules is the key feature of the nano-conjugates.

Research in the field of Experimental Biomimetics: Our activities in the area of biomimetic systems, which are very useful to understand the complex biomolecular systems and works excellent as templates for the synthesis of nano-materials are also evident from our publications.

Research in the field of Biomedical Instrumentation: Finally our heartiest effort to bring the frontier research to common people in our society in terms of lost cost spectroscopic gadgets for the biomedical/environmental usage are obvious from our publications in allied science journals and patents.

Proposed research activities for the coming year

1. **Plan on Experimental Biophysics:** Understanding of the ultrafast biomolecular processes (with nanosecond resolution) including early event of molecular recognition and structural events in proteins and DNA by using microfluidic/nanofluidic techniques attached to our existing picosecond/femtosecond facility will be one of focus areas of my group. Our preliminary works in this direction already reflects some promise for our future activities.
2. **Plan on Bio-nano Interface:** Non-invasive control of biological function by using magnetic field to the nanomagnets encapsulated in biological macromolecules would be our aim in near future. Exploration of the photo-processes in various nanomaterials including ZnO for the better dye sensitized solar cell application would also be our aim in our future studies.
3. **Plan on Biomimetics Studies:** Understanding the complex biomolecular reaction in chemically controllable environments of physiologically relevance will be the future activities. Synthesis of various nano-materials by solution routes for the biological application will also be our future works.
4. **Plan on Biomedical Instrumentation Studies:** Bringing science to the reach of common people in the form of technology is the motivation.