Dr. Tamal Banerjee

Personal Profile

Dr. Tamal Banerjee
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Academic Profile

2007 **Ph.D.** in Chemical Engineering, IIT Kanpur
Thesis Topic: "*Ionic Liquids - Phase Equilibria and Thermodynamic Property Predictions using Molecular Modeling and Dynamics, and their Validation with Experiments*"

2002 **M. Tech**. in Chemical Engineering, IIT Roorkee
Thesis Topic: "*Synthesis and Characterization of Room Temperature Ionic Liquids and its Application to Benzene-Hexane System"*

2000 **B.E** Chemical Engineering, University of Pune

Professional Appointment

- **Professor**, Indian Institute of Technology Guwahati, (Jan 2017-)
- **Associate Professor**, Indian Institute of Technology Guwahati, (Jan 2013-December 2016)
- **Assistant Professor,** Indian Institute of Technology Guwahati, (June 2007-December 2012)
- **Senior Lecturer,** Indian Institute of Technology Guwahati, (December 2006 - May 2007)
- **University Associate**, Curtin University (2020-)
- **Supplemental Faculty**, University of Delaware,USA (2011-2012)

Research Interest

- Polymeric Gels
- Separations with Deep Eutectic Solvents and Ionic Liquids
- Thermal Fluids
- Supercapacitors

Teaching

(a) Courses Taught

- Chemical Engineering Thermodynamics I (CL203)
- Numerical Methods in Chemical Engineering (CL305)
- Mechanical Operations & Thermodynamics Laboratory (CL311)
- Chemical Reaction Engineering (CL303)
- Chemical Engineering Thermodynamics II (CL207)

- Chemical Process Technology (CL 401)
- Advanced Thermodynamics (CL503)
- Molecular Simulations in Chemical Engineering (CL622)
- Applied Statistical Thermodynamics(CL633)
- Characterization of Materials (CL513)
- Computer Aided Process Equipment Design (CL312)

(b) **Recent Invited Talks**

1. *Ionic Liquid-Based Deep Eutectic Solvents as Novel Solvent-cum-Catalyst Media for Thermal Dehydrogenation of Chemical Hydrides*. Shastri India Lecture Series, Pandit Deendayal Energy University, Gandhinagar,Sastri Lecture Series, 11th March **2022**

2. *Continuum Solvation Models for Phase Equilibria***.** Undergraduate Lecture Series, Nirma University, Ahmedabad, 29th April **2022**

3. *Molecular Modeling and Experimental Insights into the Dearomatization and Desulphurisation of Hydrocarbons with Deep Eutectic Solvents*, Theme meeting on "Ionic Liquids and Deep Eutectic Solvents", BARC Mumbai,2nd March **2022**

4. *Chemical Hydrides: Potential Solution for Hydrogen based Economy?* Future of Chemical Engineering (FCE-2021) , IIT Dhanbad, 22nd March **2021**

5. *Thermolytic Dehydrogenation of Amine Boranes with Ionic Liquids and Deep Eutectic Solvents*. NIT Surat, 4th February **2021**

6. *Polysaccharide and Protein based Hydrogels for Environmental Application*. February 6th to 10th, **2021** on 'Sustainable Trends in Energy & Environment (STEE-**2021**), IET, Lucknow

7. *Synthesis and Characterization of Polysaccharide and Protein based Hydrogels for various applications*. COMPFLU-2020: 14th International Conference on Complex Fluids and Soft Matter, IIT Bombay,10th to 12th December,**2020**,INDIA

8. *Degradation Kinetics of Quinoline with Reactive Molecular Dynamics Simulation*. Molecular Simulations of Complex Fluids and Interfaces. February 21 to 23,**2020** .Indian Institute of Technology Kanpur,INDIA

9. *Molecular Modeling Studies involving the Dissolution of Lignocellulosic Biomass with Ionic Liquids and Deep Eutectic Solvents*. DAE Computational Chemistry Symposium,7th to 9th November **2019**, BARC Mumbai,INDIA

10. *Multiscale Modeling Strategies for the Solvation of Cellulose in Ionic Liquids.* Workshop on "SUSTEC Technologies to improve sustainability of lignocellulosic processes and products". Universidad Politécnica de Madrid , Madrid, June 28th to 30th, **2019**,SPAIN

11. *A Priori Prediction of Liquid-Liquid-Liquid Equilibria using COSMO-SAC Model*.22nd International Conference for Chemical Thermodynamics 2019 (RCCT-2019),June 19-23rd, **2019**, St. Petersburg, RUSSIA

12. *Experimental, Phase Equilibria and Molecular Modeling Insights for the Extraction of Hydrocarbons with Green Solvent*s. HPCL Green R and D, Bangalore, 7th August **2018**

13. *Molecular Modelling Insights of Deep Eutectic Mixtures as Media for Extractive and Thermal Applications*. COMPFLU-2018: 12th International Conference on Complex Fluids and Soft Matter, IIT Roorkee,6th to 9th December,**2018**,INDIA

Research Guided

(a) *PhD Thesis* guided (15 completed as given below +7 continuing)

1. **Dr. R. Anantharaj (2008-2012)**
   Thesis title: Simultaneous Desulphurization and Denitrification of Diesel oil using Ionic Liquids with Quantum Chemical Prediction and Validation.
2. **Dr. Ananth Praveen Kumar (2009-2013)**
   Thesis title: Interfacial Dynamics of functional liquids over porous media.
3. **Dr. S. R. Pilli (2010-2015)**
   Thesis title: Extraction of Endocrine–Disrupting Compounds from Aqueous Solutions using Ionic Liquids: Theoretical Predictions and Experimentations using Supported Liquid Membrane
4. **Dr. D. V. Rabari (2012-2015)**
   Thesis title: Experimental, Modelling and Optimization Insights for the Enhancement of Butanol Production using Phosphonium based Ionic Liquids
5. **Dr. Sanjukta Bhoi (2012-2017)**
   Thesis title: Dispersion and Dissolution of Indian Coal in Ionic Liquids: Theoretical Predictions and Experimental Validation
6. **Dr. Anand Bharti (2013-2017)**
   Thesis title: Multiscale Modeling and Experimental studies on Bio-Oil Upgradation
7. **Dr. Mayur Kevat (2013-2018)**
   Thesis title: Simulation Of Chemical Looping Combustion Using Coal and Biomass Mixtures
8. **Dr. Basudhrity Banerjee (2013-2018)**
   Thesis title: Ionic Liquid Supported Thermal Dehydrogenation Of Ammonia Borane
9. **Dr. Rima Biswas (2014-2018)**
   Thesis title: Quantum Chemical and Molecular Dynamics Insights into the Solvent Extraction and Stripping Mechanism of Metal Ions in Aqueous Biphasic Systems
10. **Dr. Mood Mohan (2014-2018)**
    Thesis title: Dissolution of Lignocellulosic Biomass in Ionic Liquids: Insights from Molecular Modeling and Experimental Studies

11. **Dr. Rupesh Verma (2012-2018)**
    Thesis title: Liquid-Liquid Extraction and Process Flow sheeting of Lower Alcohol with Deep Eutectic Solvents
12. **Dr. Debashis Kundu (2015-2019)**
    Thesis title: Development of Cellulose, Hemicellulose and Cyclodextrin based hydrogels for the in-vitro Release of Biomolecules and Metal Ion Adsorption
13. **Dr. Papu Kumar Naik (2014-2019)**
    Thesis title: Molecular Modeling and Thermodynamic Studies on the Selective Extraction of Poly Aromatic Hydrocarbons from Fuel oil using Deep Eutectic Solvent
14. **Dr. Pyarimohan Dehury (2015-2021)**
    Thesis Title: Nanoparticle Dispersed Deep Eutectic Solvents as Low-Cost Heat Transfer fluid for Concentrated Solar Power
15. **Dr. Upasana Mahanta (2016-2021)**
    Thesis Title: Ionic Liquids and Deep Eutectic Solvents as Electrolytes for Energy Efficient Electrical Double Layer Capacitor

(b) *MTech Thesis* (20 completed and 2 undergoing)
(c) *BTech Thesis* (22 completed and 2 continuing)

Research and Academic Projects Undertaken

Sponsored Projects **:**

1. **Title**: Sustainable, Biodegradable and Affordable Substitutes for 'Single use Plastic' using Castor Oil and Stubble Aggregate
   Duration: 2021-2024
   Funding agency: DST-Waste Management Technology, Department of Science and Technology (DST)

2. **Title:** Deep Eutectic Mixtures with Graphene Functionalized Nanofluids for Indirect Solar Desalination using Multistage Flash Approach
   Duration: 2020 - 2023
   Funding agency: SERB, Department of Science and Technology (DST)

3. **Title:** Development of Novel Deep Eutectic Solvents for the Extraction of Aromatics for Production of Food Grade Hexane and Straight run Kerosene using COSMO-SAC Screening.
   Duration: 2019 - 2021
   Funding agency: Hindustan Petroleum Corporation Limited, HP-Green

4. **Title:** Hydrophobic Deep Eutectic Solvent for Remediation of Antifugal and Antiobiotics in Waste water.
   Duration: 2019 - 2021
   Funding agency: Scheme for Promotion of Academic and Research Collaboration (SPARC) MHRD, Govt. of India

5. **Title:** Ionic Liquid and deep eutectic solvents as electrolytes for energy efficient electrochemical double layer capacitor.
   Duration: 2016 - 2019
   Funding agency: RESPOND-ISRO, Govt. of India

6. **Title:** Nanoparticle Dispersed Deep Eutectic Solvents as Low Cost Heat Transfer fluid for Concentrated Solar Thermal Power Plant.
   Duration: 2017 - 2020
   Funding agency: IMPRINT India, MHRD, Govt of India

7. **Title**: GIAN course on "Integration of Molecular Design to Process Simulation for the Development of Industrial Chemical Products and Processes
   Duration: 12-17th December 2016
   Funding agency: Ministry of Human Resource and Development, Government of India

8. **Title:** Quantum Chemical Understanding of Solvent Extraction Mechanism of Metal Ions in Novel Ionic Liquid Medium.
   Duration: 2013 - 2016
   Funding agency: Board of Research in Nuclear Sciences (BRNS), Govt of India

9. **Title:** Ionic Liquid assisted Thermal Dehydrogentation of Ammonia Borane.
   Duration: 2013 - 2016
   Funding agency: SERB, Department of Science and Technology (DST)

10. **Title:** Dispersion and Dissolution of Coal in Ionic Liquids: Theoretical Predictions and Experimental Validation.
    Duration: 2012 - 2015
    Funding agency: Council of Scientific and Industrial Research (CSIR)

11. **Title:** Simultaneous Desulphurization and Denitrification of Diesel oil using Ionic Liquids with Quantum Chemical Prediction and Validation.
    Duration: 2008 - 2011
    Funding agency: Fast Track Scheme, Department of Science and Technology (DST)

Consultancy Projects **:**

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1 **Title:** Co-developer for Course entitled "Numerical Methods for Chemical Engineering" under the project entitled "Developing suitable pedagogical methods for various classes, intellectual calibres and e-learning"(**2011**)
Funding agency: Ministry of Human Resource and Development, Government of India
Link: http://www.ide.iitkgp.ernet.in/Pedagogy_view/example.jsp?USER_ID=178

2 **Title:** Co-developer for NPTEL web course entitled "Molecular Simulation in Chemical Engineering" (**2012**)
Funding agency: Ministry of Human Resource and Development, Government of India
Link: http://nptel.ac.in/courses/103103036/

3 **Title:** Investigation of Thermodynamic Properties of Kerosene Samples (**2014**)
Funding agency: Jyothy Labarotories, Mumbai

4 **Title:** Conversion of WP to WA **(2021)**
Funding agency: Sheenlac Paints,Chennai

5 **Title:** NPTEL-MOOCS Course on **"**Physical and Electrochemical Characterizations in Chemical Engineering" (January 2022-March 2022)
Funding agency: Ministry of Education, Govt. of India
Link: https://onlinecourses.nptel.ac.in/noc22_ch23/preview

Research Publications

(a) Books

1. Papu Kumar Naik, Nikhil Kumar, Nabendu Paul, Tamal Banerjee. *Deep Eutectic Solvents in Liquid-Liquid Extraction Correlation and Molecular Dynamics Simulation* (**2022**).ISBN: 9781003231158.CRC Press.
2. Tamal Banerjee, Anand Bharti, Debashis Kundu and Dharamashi Rabari. *Phase Equilibria in Ionic Liquid Facilitated Liquid–Liquid Extractions* (**2017**). ISBN: 9781498769488.CRC Press.
3. Tamal Banerjee and Ramalingam Anantharaj. *Desulphurization and Denitrification of Diesel Oil using Ionic Liquids* (**2015**). ISBN: 978-0-12-801347-2.Elsevier,MA, USA

(b) Book Chapter

4. Sushma P. Ijardar, Arvind Kumar, Debashis Kundu, Tamal Banerjee, and Naved I. Malek, Application of Thermodynamic Model for Prediction of Experimental Solubility of Alkali Metal Halides in Aqueous Organic Solvent in book "Theoretical Models and Experimental Approaches in Physical Chemistry Research Methodology and Practical Methods" (2018). Apple Academic Press, ISBN: 9781771886321, pp 83-114.

(c) Patent:

1. *Alumina based Deep Eutectic Solvent comprising Benzophenone and Biphenyl as Heat Transfer Media*, Indian Patent Office, Patent No. 202231022230, 16th May **2022 (**FILED)
2. *A Deep Eutectic solution as heat transfer fluid comprising Diphenyl Ether and Benzophenone*, Indian Patent Office, Patent No. 387491, 30th December **2020**(GRANTED)

(d) **International Journals (total 133 SCI Published Journals with 4000 citation and h-index of 33)** **https://scholar.google.co.in/citations?user=iSwkMbMAAAAJ&hl=en**

Recent Publications

1 Arindam Dutta,Shirsendu Mitra,Mitali Basak,**Tamal Banerjee**. A comprehensive review on batteries and supercapacitors: Development and challenges since their inception. *Energy Storage*,(**2022**) https://doi.org/10.1002/est2.339

2 Tooba Fatma, **Tamal Banerjee**.Wet Beneficiation Characteristics of Indian Bituminous Coal with Low Cost Choline Chloride based Deep Eutectic Solvents*, International Journal of Coal Preparation and Utilization*, 42:3(**2022**) 863-877

3 Nabendu Paul and **Tamal Banerjee**. Study on the Extraction of Acetamiprid and Imidacloprid from an Aqueous Environment Using Menthol-Based Hydrophobic Eutectic Solvents: Quantum Chemical and Molecular Dynamics Insights. *ACS Sustainable Chemistry & Engineering* 10(**2022)** 4227-4246

4 Dhirendra Kumar Mishra, Raghibul Hussain, Gopal Pugazhenthi, and **Tamal Banerjee**. Catalytic Effect of Ionic Liquid Induced H2-Release from Morpholine Borane Complex: An Efficient Hydrogen Storage Carrier, *ACS Sustainable Chemistry & Engineering.*10(**2022**)6157-6164

5 Nipu Kumar Das, Papu Kumar Naik, Dhileep N. Reddy, Bhabani S. Mallik, Surya Sarathi Bose, **Tamal Banerjee**. Experimental and Molecular Dynamic Insights on the Thermophysical properties for MWCNT-Phosphonium based Eutectic Thermal Media.*J. Mol. Liq.* (**2022**) 354, 118892

6 A Ganguly, P.Bairagya, **Tamal Banerjee**; D. Kundu; Application of nature-inspired algorithms with generalized Pitzer-Debye-Hückel (PDH) refinement for liquid liquid equilibria (LLE) correlation in cyclic di-ether systems. *AIChE Journal* 68(**2022**)e17434

7 N.Kumar, **Tamal Banerjee**; Molecular Mechanism and Solubility Performance Evaluation for Separation of Benzothiophene and Model Diesel Compounds through Deep Eutectic Solvents as Extractants. *Ind. Eng. Chem. Res*. 61(**2022**) 1464–1474

Achievements/Awards

- Guest Editor for Special Issue titled “Ionic liquids and Deep Eutectic Solvents: two contrasting options or opposite sides of the same coin?” Frontiers in Chemistry **2022**
- Fellow of Indian Chemical Society (FICS),2**021**
- Fellow of Royal Society of Chemistry(FRSC),**2021**
- Editorial Board Member of *Fluid Phase Equilibria*(**2020-**), Elsevier.
- Certificate of Excellence in Reviewing from Fluid Phase Equilibria (Elsevier) **2013**
- Recipient of "*INDO-US Fellowship*" in Engineering Sciences, **2011** from the INDO-US Science and Technology Forum(IUSSTF)

- Certificate of Appreciation from American Chemical Society(ACS),December **2011** as the most valuable reviewer
- Highest Cited Article titled “Quantum Chemical Studies on the Simultaneous Interaction of Thiophene and Pyridine with Ionic Liquid” of **2010** for American Journal of Chemical Engineers (AIChEJ)

Reviewer of Journals

Nature Communications, RSC Advances, Journal of Physical Chemistry B, Chemical Communications, Chemical Physics Letters, Physical Chemistry Chemical Physics, ACS Sustainable Chemistry and Engineering, American Institute of Chemical Engineers Journal, Chemical Engineering Science, Chemical Engineering Journal, Fluid Phase Equilibria, Chemical Engineering Technology, Separation Science and Technology, Separation and Purification Technology, Fuel Processing Technology, Journal of Chemical Engineering Data, Canadian Journal of Chemical Engineering, Journal of Chemical Thermodynamics, Industrial Engineering Chemistry Research

(**Tamal Banerjee**)