

Dr. Koustuv Ray

Assistant Professor

Department of Chemical Engineering

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PROFESSIONAL EXPERIENCE:

December 2018 - Present: Indian Institute of Technology Kharagpur, India.
Assistant Professor, Department of Chemical Engineering.

August 2018 - November 2018: Indian Institute of Technology Kanpur, India.
Project Engineer, Department of Chemical Engineering.

EDUCATION:

July 2013 - June 2018: Department of Chemical Engineering, IIT Kanpur, India.

Ph.D. in Chemical Engineering, Advisor: Professor Goutam Deo.

Dissertation: "*Design and understanding of the catalytic activity trend of Al₂O₃ supported Ni and Ni-M (M=Fe, Co, Cu) alloy catalysts for CO₂ methanation and CO₂ reforming of CH₄ reactions*"

July 2011 - May 2013: Department of Chemical Engineering, IIT Kanpur, India.

M. Tech. in Chemical Engineering, Advisor: Professor Goutam Deo.

Master's Thesis: "*Catalytic activity of alumina supported Ni-based bimetallic catalysts for reactions involving CH₄ and CO₂*"

July 2007 - May 2011: Department of Chemical Engineering, Jadavpur University, India.

B.E. in Chemical Engineering (First Class with Honours)

TEACHING INTERESTS

Chemical Reaction Engineering, Chemical Engineering Thermodynamics, Chemical Process Calculations, Application of DFT in Chemical Engineering

TEACHING RESPONSIBILITIES:

SUBJECTS

- Petroleum Refinery Engineering (Post Graduate Elective course)
- Computer Aided Process Engineering (Under Graduate core course)
- Engineering Thermodynamics (Under graduate core course)

LABORATORIES

- Fuel (Under Graduate core course)
- Fluid Flow (Under Graduate core course)
- Process Equipment Design (Under Graduate core course)
- Reaction Engineering (Under Graduate core course)

RESEARCH INTERESTS

Computational and Experimental Heterogeneous Catalysis, Ab-initio Density Functional Theory for materials design, Microkinetic modelling

RESEARCH STUDENTS:

- Doctorate of Philosophy curriculum (1 on-going)
- Master of Technology curriculum (1 guided, 2 on-going)
- Bachelor of Technology curriculum (4 guided, 4 on-going)

ACADEMIC ACHIEVEMENTS

AWARDS:

- **Best Paper Award** in **CHEMCON 2016**, Chennai, India
- Received **ECTS points** and passed the PhD course on **10540 CAMD Summer School on Electronic Structure Theory and Materials Design, August, 2016** at **Technical University of Denmark**
- Received **Ambuja's Young Researcher's Awards** from **IICChE** during **CHEMCON 2013**
- **Best Poster Award** in **2nd International Conference on Materials for Energy, ENMAT II-2013**, Karlsruhe, Germany
- Awarded **The Certificate of Merit for Academic Excellence** in the **Master of Technology Programme in Chemical Engineering (2011-12)**, IIT Kanpur
- Awarded **Third Prize in Paper Presentation** in **SCHEMCON 2010**, Guntur, India
- Awarded **Indu Bhusan Putatunda and Shanti Sudha Putatunda Memorial Award-2009** From The Alumni Association NCE Bengal & Jadavpur University

LIST OF PUBLICATIONS:

1. "Descriptor-based analysis of activity and stability of Ni alloy catalysts for dry reforming of methane" by **K Ray**, A S Sandupatla, G Deo; *International Journal of Quantum Chemistry*, (2020), under review.
2. "Thermodynamic equilibrium analysis on oxidative dehydrogenation of propane using CO₂: finding a suitable reactant ratio for propylene formation" by A Pattnaik, S Sehgal, G Kumar, **K Ray**, D Pandey; *Journal of the Indian Chemical Society*, 97 (2020) 1-5.
3. "Oxidative dehydrogenation of propane over alumina supported vanadia catalyst - Effect of carbon dioxide and secondary surface metal oxide additive" by A S Sandupatla, **K Ray**, P Thaosen, C Sivananda, G Deo; *Catalysis Today*, 354 (2020) 176-182.
4. "Developing descriptors for CO₂ methanation and CO₂ reforming of CH₄ over Al₂O₃ supported Ni and low-cost Ni based alloy catalysts" by **K Ray**, R Bhardwaj, B Singh and G Deo; *Physical Chemistry Chemical Physics*, 20 (2018) 15939-15950.
5. "Promotion of Unsupported Nickel Catalyst using Iron for CO₂ Hydrogenation Reaction" by D Pandey, **K Ray**, R Bhardwaj, S Bojja, K V R Chary and G Deo; *International Journal of Hydrogen Energy*, 43 (2018) 4987-5000.
6. "A potential descriptor for the CO₂ hydrogenation to CH₄ over Al₂O₃ supported Ni and Ni-based alloy catalysts" by **K Ray** and G Deo; *Applied Catalysis B: Environmental*, 218 (2017) 525-537.
7. "Reforming and Cracking of CH₄ over Al₂O₃ supported Ni, Ni-Fe and Ni-Co catalysts" by **K Ray**, S Sengupta and G Deo; *Fuel Processing Technology*, 156 (2017) 195-203.
8. "The effects of modifying the Ni/Al₂O₃ catalyst with cobalt on the catalytic reforming of CH₄ with CO₂ and cracking of CH₄ reactions" by S Sengupta, **K Ray** and G Deo; *International Journal of Hydrogen Energy*, 39 (2014) 11462-11472.

CONFERENCE PROCEEDINGS:

1. Goutam Deo, **Koustuv Ray**, Aditya S Sandupatla, Siddhartha Sengupta, Sudhir C Nayak, Puneet K Chaudhary, Neeraj Koshta, "Good Catalyst Better Catalyst for the CO₂ Reforming of CH₄: A Bit of Science and Engineering for This Catalytic Reaction", **North American Catalysis Society Meeting, NAM-26**, Chicago, June, 2019

2. **Koustuv Ray**, Siddhartha Sengupta and Goutam Deo, "Correlating catalytic activity with electronic property for CO₂ reforming of CH₄ over Ni and Ni-based alloy catalysts", **Asia-Pacific Congress on Catalysis, APCAT-7**, Mumbai, India, January 2017
3. Devendra Verma, **Koustuv Ray** and Goutam Deo, "Kinetic modeling of CO₂ methanation over Ni/Al₂O₃ and Ni-Fe/Al₂O₃" presented in **CHEMCON-2016**, IIT-M, CHENNAI, A.C. TECH, ANNA UNIVERSITY, CLRI (CSIR), Chennai, India, December 2016.
4. **Koustuv Ray**, Aditya Sandupatla, Smita R. Biswal and Goutam Deo, "Steps towards understanding the improved activity of some Ni-based bimetallic catalysts", **252nd ACS National Meeting**, Philadelphia, USA, August 2016.
5. **Koustuv Ray** and Goutam Deo, "Steps towards understanding the improved activity of some Ni-based bimetallic catalysts", **2016 CAMD Summer School on Electronic Structure Theory and Materials Design**, DTU Physics, DTU, Lyngby, Denmark, August 2016.
6. **Koustuv Ray**, Smita Ranjan Biswal and Goutam Deo, "Density Functional Theory and Molecular Dynamics studies of Ni based alloys", **68th Annual Session of Indian Institute of Chemical Engineers CHEMCON-2015**, Guwahati, India, December 2015.
7. **Koustuv Ray**, Dharmendra Pandey, Bahadur Singh, Rajendra Prasad and Goutam Deo, "A Computational Approach to Understand the Promotional Effect in Ni-Fe Bimetallic Catalyst", **12th European Congress on Catalysis – EuropaCat-XII**, Kazan, Russia, August 2015.
8. Goutam Deo, Siddhartha Sengupta, Dharmendra Pandey and **Koustuv Ray**, "Promotion of the Ni/Al₂O₃ catalyst by Co and Fe for: (i) reforming of CH₄ with CO₂, (ii) cracking of CH₄ and (iii) CO₂ hydrogenation", **University of Queensland – India Workshop on Applications of Nanotechnology and Catalysis in Clean Energy, Biofuels, Chemicals and Hydrogen Generation**, Brisbane, Australia, November 2013.
9. **Koustuv Ray**, Siddhartha Sengupta and Goutam Deo, "Catalytic activity of alumina supported Ni-based bimetallic catalysts for reactions involving CH₄ and CO₂", **2nd International Conference on Materials for Energy, ENMAT II**, Karlsruhe, Germany, May 2013.
10. Siddhartha Sengupta, **Koustuv Ray** and Goutam Deo, "Promotion of the Ni/Al₂O₃ Catalyst for the Reforming of CH₄ with CO₂ and Cracking of CH₄", **21st National Symposium on Catalysis-2013**, IICT, Hyderabad, India, February 2013.
11. **Koustuv Ray**, Siddhartha Sengupta and Goutam Deo, "Striking aspects of Al₂O₃ supported Ni-Co bimetallic catalyst", **65th Annual Session of Indian Institute of Chemical Engineers CHEMCON-2012**, Jalandhar, India, December 2012.

SKILLS

EXPERIMENTAL TECHNIQUES: BET, Pulse Chemisorption, XRD, Temperature Programmed Reaction Studies, Spectroscopy (FTIR, Raman, UV-Vis-NIR), High temperature fixed bed reaction operation, *in-situ* studies, Gas Chromatography (TCD, FID)

COMPUTATIONAL TECHNIQUES: Density Functional Theory calculations, Mathematical Modelling

SOFTWARE/PACKAGES: MATERIALS STUDIO, VASP, MATLAB, ORIGIN, ASPEN Plus

INTERESTS & HOBBIES: Playing outdoor games specially Football, Photography, Swimming