**MANPREET KAUR**

*Calgary Advanced Energy Conversion and Storage Research -Technology,*

Department of Chemical and Petroleum Engineering,

University of Calgary, CANADA

Editorial Board Member of Resources, Environment and Sustainability (Elsevier)

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*My passion is to serve human well-being and social justice. By working on improving energy conversion efficiency through metal-semiconductor nanostructures, I envision a future where we as humans only depend on renewable energy sources for energy. Outside the lab, I love to travel and to immerse myself in different cultural experiences.*

**Research Interests:** Electrochemistry; Nano-materials synthesis; Materials science; Graphene quantum dots; Electrode materials; Energy conversion and storage devices; Photo-Electro-Catalysis.

**Employment**

* **Post Doctorate Research Associate, Department of Chemical and Petroleum Engineering, University of Calgary, Dec 2022- till date.**

*Research focus:*

* Core-Shell Nanomaterials: Design and synthesis of 0D, 1D and 2D nanomaterials with customizable architectures and pore sizes for applications in polymer electrolyte fuel cells, electrolysers, sensors and batteries.
* Catalytic Reactions: Exploration of electro- and photocatalytic processes for the upcycling of methane and nitrogen.
* Hybrid Nanostructures: Synthesis of ammonia, methanol, ethanol, and similar compounds utilizing metal-semiconductor, graphene, and MXene-based hybrid nanostructures.

*Duties:*

* Catalyst Development: Synthesizing catalysts, preparing catalyst layers, and assembling fuel cells, followed by performance diagnostics using fuel cell testing units.
* Electrochemical Measurements: Measuring electrochemical active areas using Rotating Disk Electrode (RDE) techniques.
* High-performance liquid chromatography (HPLC)
* Gas chromatography–mass spectrometry (GC–MS) Operation: Operating GC-MS instruments for analyzing various volatile components.
* Internship Training: training and guidance to Mitacs fellows during their internships.
* **Post Doctorate Researcher, Regional Centre of Advanced Technologies and Materials (RCPTM), Palacký University, CZECH REPUBLIC and University of Turin, ITALY, Jan 2021- May 2022.**

*Research focus:*

* Selective catalytic oxidation of organic compounds into useful bio-based polymer using quantum dots.
* Synthesis and utilization of metal-semiconductor quantum dots for CO2 reduction and hydrogen generation application.
* Sample analysis and maintenance of High-performance liquid chromatography (HPLC) and X-rays Diffraction (XRD)
* **Post Doctorate Researcher, National Institute for Materials Science, Tsukuba, JAPAN, Oct 2019 -Dec 2020.**

*Research focus:*

* Research for an alternative plasmonic nano-materials for energy harvesting application.
* Metallic-semiconductor core-shell structure for photovoltaics, photocatalysis and water splitting applications.
* Cleanroom duties: reactive ion etching, chemical and Physical vapor deposition, lithography etc.
* **Junior Researcher, National Institute for Materials Science, Tsukuba, JAPAN, Oct 2016 -Sept 2019.**

*Research focus:*

* Photothermal effect of plasmonic hybrid composite structure for highly efficient sunlight-driven water desalination applications
* Cleanroom duties: reactive ion etching, chemical and Physical vapor deposition, lithography etc.

**Education:**

* **Ph.D. in Materials science, Condensed Matter Physics, Hokkaido university, JAPAN, Oct 2016-Sept 2019.**

*Research focus:*

* Photothermal and photoelectric conversion with plasmonic nanomaterials for water purification and water splitting
* Photocatalysis using metallic-semiconductor core-shell nanostructure
* Fabrication and optical properties study of metallic (Bi, Ga, TiN) nanowires
* **Master of Nanotechnology Engineering (5-year integrated), Sri Guru Granth Sahib World University, Punjab, INDIA, 2011-2016, CGPA 8.4/10**

Thesis title: Titanium nitride (TiN) nanoparticles for energy harvesting applications

**Training/Skills:**

* **In charge/Operator.** GC-MS, High-performance liquid chromatography (HPLC), Electrochemical work station operator.
* **Synthesis and Fabrication.** Semiconductor and metallic Quantum-dots /nanoparticles/nanowires/nanorods/nanotubes synthesis: Wet-chemical synthesis, Solvothermal, Hydrothermal, High temperature growth method, Chemical reduction, Coprecipitation, Microemulsion and Inverse Microemulsion, Atomic layer deposition (ALD), Chemical vapor deposition, Reactive ion etching, Photolithography, Dry and wet etching, Electrochemical anodization.
* **Catalytic Reactions.** Methane-assisted upgrading, Nitrogen conversion to NH3, Biomass upgrading to value-added fuels and chemicals, Oxygen reduction reaction, Hydrogen evolution reaction.
* **Measurement.** HPLC, GC-MS, Fuel cell testing unit,Ellipsometry, XRD, UV-Visible spectroscopy, Electron paramagnetic resonance spectroscopy, FTIR- Raman spectroscopy, AFM, SEM, EDX, TG/DTA, I-V measurement, Photoluminance spectroscopy.
* **Software Knowledge.** RSOFT and COMSOL for electromagnetic and energy transfer simulation software.

**Recognition/Awards/Scholarships:**

* “Young Researcher Presentation Award” **M. Kaur**, at 11th Indian Scientist Association in

Japan for “[Plasmonic](https://samurai.nims.go.jp/presentations/43ac77fc-689c-40a0-93fb-44feb91d06eb) based Core-shell (TiN/SiO2/TiO2) nanocomposite for eco-friendly

water treatment” **6th December** **2020**.

* Young Scientist Award, **M. Kaur,** by Japan Society of Vacuum and Surface Science for

plasmonic based solar energy harvesting device**,** **May 2020**.

<https://www.nims.go.jp/mana/news_room/awards/2020103001.html>

* Research Funding: For “Fabrication of an efficient seawater desalination system”, **2019**

<https://academist-cf.com/projects/97?lang=en>

* Best oral presentation award, at 9th ISAJ symposium held at AIST, Tsukuba, Japan, **2018**

for “Harvesting Sunlight for Photoelectric and Photothermal Conversions with Titanium

Nitride Nanostructures”.( <https://samurai.nims.go.jp/presentations/3a5fd00e-c40a-44e0-bf52-8f9292868ecb> )

* Excellent poster presentation award, at 10th International MANA Symposium, Japan

**2017** for “Harvesting Sunlight for Photoelectric and Photothermal Conversions with

Titanium Nitride Nanostructures”. (<https://samurai.nims.go.jp/presentations/43ac77fc-689c-40a0-93fb-44feb91d06eb> )

* Low cost and portable solar steam generator were featured in TV Tokyo (TBS) News

“*World Business Satellite*” (Broadcasted on 31 May **2019**).

* 2015/5 - 2015/6 NIST Summer Research Internship and Fellowship - 35,000 (Indian rupee),

National Institute of Science & Technology, Odisha, INDIA

* 2015/2 - 2015/2 Best Presentation Award - 2,500 (Indian rupee), Sri Guru Granth Sahib

World University, Punjab, INDIA

* 2014/1 - 2016/7 SGGSWU Tuition Fee Scholarship - 500,000 (Indian rupee), Sri Guru

Granth Sahib World University, Punjab, INDIA

**Research Grants:**

* 2023/4 - 2023/12, Co-applicant, Plasma-assisted ammonia and value-added hydrocarbons

productions from CH4 and N2, Mitacs Accelerate program, Total Funding - 80,000 CAD

* 2019/4 - 2020/3, Co-applicant, Fabrication of an efficient sea-water purification system,

Academic crowdfunding Japan, Total Funding - 631,000 (Japanese yen)

* 2016/10 - 2019/9, Principal Applicant, NIMS Junior researcher, NIMS, JAPAN, Graduate

Research Assistantship, Total Funding - 6,300,000 (Japanese yen)

**Selected Publications:**

[1] **M. Kaur**, S. Rej, J. Navrátil, M. Otyepka, P. Blonski, A. Naldoni. Near-infrared photothermal activation of molecular oxygen over Pt-Ru@TiN photocatalysts for selective oxidation of biomass derivatives. *Nature Catalysis*. **2024**, under review. (*IF: 40*)

[2] **M. Kaur**, R. Sadri, T. Roberts, H. Song. Boosting alcohol production via nitrogen-doped electrochemically exfoliated graphene and layered Ti3CN MXene hybrid photo-electrocatalyst, *Chemical Engineering Journal*, **2024**, 149261. (*IF: 15.1*), DOI: [10.1016/j.cej.2024.149261](https://doi.org/10.1016/j.cej.2024.149261)

[3] **M. Kaur**, A. Algumali, R. Sadri, T. Roberts, H. Song, Solar-Powered plasma-boosted graphene towards enhanced ammonia production, *Journal of Material Chemistry A*, **2024**, 12, 9637-9650 (*IF: 11.7*). DOI: https://doi.org/10.1039/D3TA07771C

[4] **M. Kaur**, A. Alagumalai, O. Mahian, S. Osman, N. Tadaaki, Z. L. Wang, Harvesting Energy Via Water Movement and Surface Ionics in Microfibrous Ceramic Wools, *Energy & Environmental Materials*, **2024**. e12760, (*IF: 16.6*). DOI: 10.1002/eem2.12760

[5] B. Babamiri, R. Sadri, M. Farrokhnia, M. Hassani, **M. Kaur**, E. P. L. Roberts, A. S Nezhad, Molecularly Imprinted Polymer Biosensor Based on Nitrogen-Doped Electrochemically Exfoliated Graphene/Ti3CNTX MXene Nanocomposite for Metabolites Detection, *ACS Applied Materials and Interface*s, **2024**, (*IF: 15.7*). DOI: https://doi.org/10.1021/acsami.4c01973

[6] L. Kou, S. Auwal, N. Shyan, R. Sadri, **M. Kaur**, T. Robert, M. Haniff, C. F Dee, P. C. Ooi, Enhancing Piezoelectric Performance in Advanced Human Motion-Driven Energy Harvester through Tri-doped Graphene: Ti3CNTx MXene Heterostructures, *Chemical Engineering Journal*, **2024**, Revision submitted. (*IF: 15.1*).

[7] L. Kou, S. Auwal, N. Shyan, R. Sadri, **M. Kaur**, T. Robert, M. Haniff, C. F Dee, P. C. Ooi,

Nitrogen-doped Graphene- Ti3C2Tx Quasi-3D Heterostructures Interfacial Interaction for High-Temperature Vibrational Piezoelectric Energy Harvesting Application, *ACS Applied Electronic Materials*, **2024**, (*IF: 4.7*). DOI: <https://doi.org/10.1021/acsaelm.4c00509>

[8] **M. Kaur**, H Song, Plasmonic Titanium Nitride based Ammonia Synthesis by Photo-electrocatalytic Reduction of Nitrogen, *Chemical Engineering Journal*, **2023**, 45963. (*IF: 15.1*),

[DOI: 10.1016/j.cej.2023.145963](https://doi.org/10.1016/j.cej.2023.145963)

[9] M. Kaur, Z Li, S Meng, W Li, H Song, Electrocatalytic methane conversion to high value chemicals at ambient conditions, *Energy Conversion and Management*, **2023**, 285-117029. (*IF: 11.5*), DOI: [10.1016/j.enconman.2023.117029](https://doi.org/10.1016/j.enconman.2023.117029)

[10] **M. Kaur**, T. Nagao, Minireview on Solar Desalination and Hydropower Generation by Water Evaporation: Recent Challenges and Perspectives in Materials Science, *Energy & Fuels*, **2022**, 36.19. 11443-11456. (*IF: 4.6*), DOI: [10.1021/acs.energyfuels.2c02576](https://doi.org/10.1021/acs.energyfuels.2c02576)

[11] T.N. Kevin, **M. Kaur**, S. Ishii, T. Nagao, Photothermal heating and heat transfer analysis of anodic aluminum oxide with high optical absorbance, *Nanophotonics* **2022**, 11.14: 3375-3381. (*IF: 7.9*), DOI: [10.1515/nanoph-2022-0244](https://doi.org/10.1515/nanoph-2022-0244)

[12] **M. Kaur**, S. Ishii, T. Nagao, Hydropower Generation by Transpiration from Microporous Alumina, *Scientific reports* **2021**, 10954 [11] . (*IF: 4.6*), DOI: [10.1038/s41598-021-90374-5](https://doi.org/10.1038/s41598-021-90374-5)

[13] **M. Kaur**, D. Sahu, Synthesis and Characterization of Oleic acid Stabilized CdTe Quantum

Dots and its Properties as Luminescence Quencher of a Pyridine pendented Rod-Coil Homopolymer, *Materials science*, **2020**. (*IF: 4.7*), DOI: [10.2478/msp-2020-0059](https://doi.org/10.2478/msp-2020-0059)

[14] **M. Kaur**, S. L. Shinde, S. Ishii, N. Fukata, W. Jevasum, Y. Le, J. Ye, T. Nagao, Marimo Bead- Supported Core-Shell Nanocomposites of Titanium Nitride and Chromium-Doped Titanium Dioxide as Highly Efficient Water Floatable Green Photocatalyst, *ACS Applied Materials & Interfaces*, **2020**. (*IF: 10.4*), DOI: 10.1021/acsami.0c03781

[15] S. Ishii, S. L. Shinde, **M. Kaur**, [R.P Sugavaneshwar](https://samurai.nims.go.jp/profiles/r_p_sugavaneshwar), T. Nagao, Optical excitation of hot carriers and photothermal conversions with transition metal nitrides and transition metal carbides, *The Review of Laser Engineering* **2019**, 47[7], 365-369.(*IF: 0.5*), DOI: iss.ndl.go.jp/books/R100000002-I000000031478-00

[16] **M Kaur**, A Sharma, M Olutas, O Erdem, A Kumar, M Sharma, HV Demir. (2018). Cd-free Cu-doped ZnInS/ZnS core/shell nanocrystals: Controlled synthesisand photophysical properties. *Nanoscale Research Letters.* 13: 1-11. (*IF: 5.5*), DOI: 10.1186/s11671-018-2599-x

[17] S. Ishii, [S.L. Shinde](https://samurai.nims.go.jp/profiles/shinde_satishlaxman), R.P. Sugavaneshwar, **M. Kaur**, [T. Nagao](https://samurai.nims.go.jp/profiles/nagao_tadaaki). [Harvesting Sunlight with Titanium Nitride Nanostructures](https://samurai.nims.go.jp/proceedings/cec1ac9b-e842-4f61-b1a2-f466d6a7c069). *Progress in Electromagnetics Research Symposium (PIERS-Toyama)* **2018**, 1, 1286-1289. *(IF: 6.0*), DOI:10.23919/PIERS.2018.8598236

[18] **M. Kaur**, S. Ishii, S. L. Shinde, T. Nagao, All-Ceramic Solar-Driven Water Purifier Based

on Anodized Aluminum Oxide and Plasmonic Titanium Nitride, *Advanced Sustainable Systems* **2018**, 3[2], 1800112. *(IF: 7.1*), DOI:[10.1021/acssuschemeng.7b02089](https://doi.org/10.1021/acssuschemeng.7b02089)

[19] **M. Kaur**, S. Ishii, S. L. Shinde, T. Nagao, All-Ceramic Microfibrous Solar Steam Generator: TiN Plasmonic Nanoparticle-Loaded Transparent Microfibers, *ACS Sustainable Chemistry &* *Engineering* **2017**, 5, 8523.*(IF: 9.2*), DOI: [10.1002/adsu.201800112](https://doi.org/10.1002/adsu.201800112)

**Books:**

S. Ishii, K. Chen, [R.P Sugavaneshwar](https://samurai.nims.go.jp/profiles/r_p_sugavaneshwar), H. Okuyama, T.D. Dao, S.L. [Shinde,](https://samurai.nims.go.jp/profiles/shinde_satishlaxman) [**M. Kaur**](https://samurai.nims.go.jp/profiles/manpreet_kaur), M.

Kitajima, [T. Nagao](https://samurai.nims.go.jp/profiles/nagao_tadaaki). Efficient absorption of sunlight using resonant nanoparticles for solar heat applications. **2018**, *Wiley Online Library*, Chapter 14, Page 241-253.**DOI:** 10.1002/9783527808311.ch14:

**International Appointments:**

 Editorial Board Member, International Journal of Renewable Energy Technology, Interscience (July 2023 - Present)

 Editorial Board Member, Thermal Science and Energy Systems, Frontiers (May 2023 - Present)