Dr. Jitendra Kumar

Current position: INSPIRE Faculty, Indian Institute of Technology Dhanbad, India

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Education

2012-2019 **Doctor of Philosophy (Ph.D.)**
Materials Science & Engineering
Indian Institute of Technology Kanpur, India
Thesis: *Synthesis and characterization of solution-processed Cu_2ZnSnS_4 thin film*
Supervisor: Prof. Sarang Ingole

2009-2011 **Master of Technology (M.Tech.)**
Nanotechnology
Indian Institute of Technology Roorkee, India
Thesis: *Modeling and simulation of silicon nanowire solar cell*
Supervisors: Prof. Sanjeev Manhas & Prof. Dharmendra Singh

2005-2009 **Bachelor of Technology (B.Tech.)**
Electronics & Communication Engineering
Uttar Pradesh Technical University, Lucknow, India

Awards and Fellowships

2023 **INSPIRE Faculty Fellowship**
Awarded fellowship and grants by *Department of Science and Technology*, Government of India to do research on $BaZrS_3$ thin film solar cell.

2023 **Marie Skłodowska-Curie Actions Seal of Excellence Recipient**
Awarded the Seal of Excellence by the European Commission for an exceptional project proposal demonstrating high potential and quality, indicating eligibility for funding from other sources.

2022 **Young Scientist Travel Grant Award**
Awarded by École Polytechnique Fédérale de Lausanne (EPFL) Lausanne, Switzerland to present my research at the *Latsis Symposium on Earth-Abundant Materials for Future Photovoltaics at EPFL*, Switzerland.

2019-2020 **Institute Postdoctoral Fellowship**
Got a postdoctoral fellowship by the Indian Institute of Technology Delhi to work in an inorganic perovskite solar cell in the Department of Chemistry, *Indian Institute of Technology Delhi*.

2018 **Best Poster Presentation Award**
Won for the poster titled "Vertical silicon nanowire platform: Application to sensors and energy harvesting" at *4th-IEEE International Conference on Emerging Electronics*, Bengaluru, India.

2018 **International Travel Support Award**
Awarded by Science and Engineering Research Board, *Department of Science and Technology*, Government of India to present my Ph.D. research at the *Materials research society fall meeting and exhibit*, Boston, USA.

2018 **Certificate of Merit**
Awarded by the *Department of Materials Science & Engineering* at the Indian Institute of Technology Kanpur for publishing a peer-reviewed research article.

2013 **Best Oral Presentation Award**
Won for an oral talk titled "Nanowire fabrication via Metal-assisted Chemical Etching" at MSE PG symposium, PADARTH, *Indian Institute of Technology Kanpur*.

Research Experience

October 2020 – Present	**Postdoctoral Researcher** (with Prof. Eran Edri) Department of Chemical Engineering, Ben-Gurion University of the Negev, Israel
October 2019 – October 2020	**Postdoctoral Researcher** (with Prof. Sameer Sapra) Department of Chemistry, Indian Institute of Technology Delhi
January 2019 – September 2020	**Project Associate** (with Prof. Anshu Gaur) Department of Materials Science & Engineering, Indian Institute of Technology Kanpur
February 2015 & September 2016	**Visiting Research** (with Prof. Roland Scheer) Photovoltaic Group, Martin Luther University, Halle - Wittenberg, Germany
April 2014 & October 2014	**Visiting Research** Center for Nanoscience and Engineering, Indian Institute of Science Bangalore

Technical Skills

Material Synthesis	Closed-spaced sublimation, Electron-beam and thermal evaporator, RF-magnetron sputtering, high-temperature selenization furnace, Hot-injection method, Sol-gel method, Chemical bath deposition, Successive ionic layer adsorption and reaction, Metal-assisted chemical etching, Electrochemical deposition, UV-lithography, Photomask aligner.
Materials Characterization	Hall measurement, Time-resolved photoluminescence, Four-probe measurement, Deep-level transient spectroscopy, X-ray photoelectron spectroscopy, Ultra-violet photoelectron spectroscopy, Raman spectroscopy, X-ray diffraction, UV-Vis-NIR spectroscopy, Scanning electron microscope, Transmission electron microscopy, Energy-dispersive X-ray spectroscopy, Ultra-violet spectroscopy, Kelvin-probe surface voltage measurement, Fourier-transform infrared spectroscopy, Atomic force microscopy, Solar Simulator and External quantum efficiency measurement.
Software Applications	Sentaurus TCAD, COMSOL Multiphysics, SCAPS-1D, PANalytical's X'Pert High Score, CasaXPS, GRAMS/AI™ spectroscopy software, ImageJ, VESTA, CrysTBox, Gatan, and Origin.

Publications

Google Scholar Profile: **Google Scholar** (https://scholar.google.com/citations?hl=en&user=zxvK3TgAAAAJ)
ORCiD Profile: **ORCiD** (https://orcid.org/0000-0002-1451-2918)

1. **Jitendra Kumar**, Eran Edri, "Solution-processed Sb_2Se_3 nanowires for photovoltaic applications" Available at SSRN: https://ssrn.com/abstract=4348366 or http://dx.doi.org/10.2139/ssrn.4348366.
2. Anchal Vashishtha, **Jitendra Kumar**, Neetika Singh, Eran Edri, "Surface Potential Variation Across (hk1) and non-(hk1) Grain Boundaries of Antimony Triselenide", *Journal of Alloys and Compounds*, 2023, 948, 169714 (I.F. 6.371).
3. Yaron Shitrit, Mahesh Duriayasu, **Jitendra Kumar**, Sivas Reddy, Yakov Cohen, Eran Edri, "Deposition of Bismuth Nanoplatelets onto Graphene Foam for Electrocatalytic CO_2 Reduction", *ACS Applied Nanomaterials*, 2022, 5, 11, 16354–16364 (I.F. 6.140).
4. **Jitendra Kumar**, Omer Vana, Subila Balakrishnan, Eran Edri, "Benign solution-processed $(Bi_xSb_{1-x})_2Se_3$ compound for short wavelength infrared mesoporous solar cells", *Journal of Materials Chemistry C*, 2022, 10, 11220 - 11231 (I.F. 8.067) [**Appeared on the front page of the Journal**].
5. **Jitendra Kumar**, Yaniv Dror, Eran Edri, "$(Bi_xSb_{1-x})_2Se_3$ thin films for short-wavelength infrared region solar cells", *Journal of Materials Chemistry C*, 2022, 10, 8702-8710 (I.F. 8.067).
6. Neha Kumari, **Jitendra Kumar**, Sarang Ingole, "Properties of Cu_2ZnSnS_4 films obtained by sulfurization under different sulfur-vapor pressures in a sealed ambient", *Solar Energy*, 2022, 231, 484-495 (I.F. 7.188).
7. **Jitendra Kumar,** Sarang Ingole, "*Optical phonons in pentanary compound $(Ag_xCu_{1-x})_2ZnSnS_4$ semiconductor: a Raman study*", *Journal of Alloys and Compounds*, 2021, 865, 158113 (I.F. 6.371).
8. **Jitendra Kumar,** Sarang Ingole, "*Scalable Fabrication and Electrical Contact formation Process for Vertically Oriented Silicon Nanopillars in Trenches*", *Materials Science in Semiconductor Processing*, 2021, 122, 105470 (I.F. 4.644).

9. **Jitendra Kumar,** Sarang Ingole, "*Tailoring the surface morphology of Cu_2ZnSnS_4 thin films for photovoltaic application*", Materials Science in Semiconductor Processing, 2019, 93, 173-181 (I.F. 4.644).
10. **Jitendra Kumar,** Sarang Ingole, "*Evolution of the microstructural, electrical and optical characteristics of sol-gel derived Cu_2ZnSnS_4 thin films during Sulfurization*", Materials Science in Semiconductor Processing, 2019, 91, 31-40 (I.F. 4.644).
11. **Jitendra Kumar**, Sarang Ingole, "*Effect of cation ratios and monoethanolamine on the morphology of solution processed Cu_2ZnSnS_4 films*", MRS Advances, 2019, 4, 945-951.
12. **Jitendra Kumar,** Sarang Ingole, "*Effect of silicon conductivity and HF/H_2O_2 ratio on the morphology of silicon nanostructures obtained via metal-assisted chemical etching*", Journal of Electronic Materials, 2018, 47, 1583-1588 (I.F. 2.047).
13. **Jitendra Kumar**, Sarang Ingole, "*Structural and optical properties of $(Ag_xCu_{1-x})_2ZnSnS_4$ thin films synthesised via solution route*", Journal of Alloys and Compounds, 2017, 727, 1089-1094 (I.F. 6.371).
14. **Jitendra Kumar**, S. K. Manhas, Dharmendra Singh, Ramesh Vaddi, "*Optimization of the vertical silicon nanowire-based solar cell using 3D TCAD simulation*", 13th-International Symposium on Integrated Circuits, Singapore, 2011, 528-531.

Conferences

1. **Jitendra Kumar**, Yaniv Dror, Omer Vana, "*$(Sb,Bi)_2Se_3$ thin films for short wavelength infrared region solar cell*", E-MRS 2023 Spring Meeting, Strasbourg, France, June 2023.
2. **Jitendra Kumar**, Omer Vana, Subila Balakrishnan, Eran Edri, "*Benign solution-processed Sb_2Se_3 and Bi-alloyed Sb_2Se_3 solar cells for the short-wavelength infrared region solar cells*", HI-SCORE All-Hands-Meeting, Helmholtz Zentrum Berlin, Germany, November 2022.
3. **Jitendra Kumar**, Omer Vana, Subila Balakrishnan, Eran Edri, "*Solution processed $(Bi_xSb_{1-x})_2Se_3$ nanowires for near-infrared solar cell*", Climate Day: Special Spotlight Event on Environmental Science, Ben-Gurion University of the Negev, Israel, November 2022.
4. **Jitendra Kumar**, Omer Vana, Eran Edri, "*Solution processed Sb_2Se_3 and $Bi_{2-x}Sb_xSe_3$ for energy applications*", 86th Annual meeting of Israel Chemical Society, Tel-Aviv, Israel, September 2022.
5. **Jitendra Kumar**, Neha Kumari, "*A study of the efficiency limiting defects in $Cu_2Ba_xZn_{1-x}SnSe_4$ thin film based solar cell*", 86th Annual meeting of Israel Chemical Society, Tel-Aviv, Israel, September 2022.
6. **Jitendra Kumar**, Sameer Sapra, "*Inorganic Perovskite $CsPbI_xBr_{3-x}$ Nanocubes and Influence of Bi Doping*", 86th Annual meeting of Israel Chemical Society, Tel-Aviv, Israel, September 2022.
7. **Jitendra Kumar**, Omer Vana, Subila, Eran Edri, "*Benign solution-processed $(Bi_xSb_{1-x})_2Se_3$ alloys for short wavelength infrared solar*", 23rd Sede Boqer Symposium on Solar Electricity Production, September 2022.
8. **Jitendra Kumar**, Neha Kumari, "*A study of the efficiency limiting defects in $Cu_2Ba_xZn_{1-x}SnSe_4$ thin film based solar cell*", The 2022 Latsis Symposium on Earth-Abundant Materials for Future Photovoltaics, EPFL, Switzerland.
9. **Jitendra Kumar**, Sarang Ingole, "*Synthesis and characterization of $(Ag_xCu_{1-x})_2ZnSnS_4$ thin film for photovoltaic application*", Virtual Chalcogenide P.V. conference 2020, May 2020, Jointly organized by Helmholtz-Zentrum Berlin, CNRS - Centre national de la recherche scientifique, Institut Photovoltaïque d'Ile-de-France (IPVF), Empa, Universität Luxemburg, AIST and Colorado State University.
10. **Jitendra Kumar**, Sarang Ingole, "*Fabrication of silicon nanowire-based device platform using deep reactive ion etching*", 4th International Conference on Emerging Electronics, Bengaluru, India, December 2018.
11. **Jitendra Kumar**, Sarang Ingole, "*Structural and electronic properties of the pentanery compound $(Ag_xCu_{1-x})_2ZnSnS_4$ synthesized via solution route*", MRS fall meeting and exhibit, Boston, USA, November 2018.
12. **Jitendra Kumar**, Sarang Ingole, "*Investigation of Cu_2ZnSnS_4 thin films using Raman spectroscopy*", International Conference on Materials Engineering, IIT Kanpur, India, June 2017.
13. **Jitendra Kumar**, Sarang Ingole, "*Application of alumina as a hard mask in Deep Reactive Ion Etching for the fabrication of micro-trenches with micro-Pillars*", 8th-ISSS National Conference on MEMS, Smart Materials, Structures and Systems, IIT Kanpur, India, September 2016.
14. **Jitendra Kumar**, Sarang Ingole, "*Morphology of Cu_2ZnSnS_4 thin films obtained through solution chemistry*" 20th International Conference on Ternary and Multinary Compounds, Halle (Saale), Germany, September 2016.
15. **Jitendra Kumar**, Sarang Ingole, "*A novel silicon nanowire-based device plate form for sensor and energy harvesting application*", National Symposium on Nano Science & Technology, CeNSE, Indian Institute of Science, Bangalore, India, June 2016.

16. **Jitendra Kumar**, Sarang Ingole, "*Copper zinc tin sulfide compound semiconductor as a solar cell absorber material*", Research Scholar's Day, Department of Materials Science & Engineering, IIT Kanpur, India, April 2015.
17. **Jitendra Kumar**, Sarang Ingole, "*Nanograss fabrication using metal-assisted chemical etching*", International Conference on Advance in Energy Material, IIT Roorkee, Saharanpur Campus, India July 2014.
18. **Jitendra Kumar**, Sarang Ingole, "*Fabrication of heavily doped N-Type silicon nanowire via metal-assisted chemical etching*", 7th-ISSS International Conference on Smart Materials, Structures and Systems, Indian Institute of Science, Bangalore, India, July 2014.
19. **Jitendra Kumar**, Sarang Ingole, "*Nanowire fabrication via metal-assisted chemical etching*", MSE PG Symposium, PADARTH, IIT Kanpur, India, November 2013.
20. **Jitendra Kumar**, S. K. Manhas, Dharmendra Singh, "*Optimization of the vertical silicon nanowire-based solar cell using 3D TCAD simulation*", 13th-International Symposium on Integrated Circuits, Singapore, December 2012.
21. **Jitendra Kumar**, S. K. Manhas, Dharmendra Singh and B. K. Kaushik, "*Optimisation of lateral silicon nanowire-based solar cell using 3D-TCAD simulation*", 15th-VLSI Design and Test Symposium, Pune, India, July 2011.

Invited Talks

1. "Bismuth-alloyed antimony selenide thin films for short wavelength infrared region solar cell applications" – Department of Materials Science & Engineering, Indian Institute of Technology Kanpur, May 2022.

Research Grants

- **Research Grant (2023-2028),** PI: Dr. Jitendra Kumar
  Chalcogenide-Perovskite ($BaZrS_3$) based Photovoltaic Devices
  Granted by: Department of Science & Technology, Government of India.

Reviewer for

- Journal of Flexible and Printed Electronics
- International Journal of Energy Research
- MRS Advances
- Nanotechnology