

Dr. Sandeep Kumar

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Research Interests

Nanoscale physics, Semiconductor nanowires, 2D materials, Nano electronic devices, Electrical and magnetic properties of nanostructures, Nanospintronics, Characterization of defects in semiconductors, Modification of materials using energetic ions

Professional Experience

- Assistant Professor (UGC-FRP) (April, 2014 to present): Central University of Rajasthan, India
- Postdoctoral Researcher (2010-2013): Lund University, Lund, Sweden
Research: "Magnetic semiconductor nanowires",
Supervisors: Prof. Lars Samuelson, Prof. Håkan Pettersson
- Postdoctoral Fellow (2008-2009): Laboratorio Nazionale TASC-INFN, Trieste, Italy.
Research: "Transport properties of semiconductor nanostructures"
Supervisor: Dr. Silvia Rubini

Education

- Ph.D (2003-2008): Inter-University Accelerator Centre (IUAC), New Delhi, India
Thesis title: Ion beam modification of metal-silicon junctions
Thesis Supervisor: Dr. D. Kanjilal
University: Jawaharlal Nehru University, New Delhi, India
- M.Sc. in Physics (2001-2003) Indian Institute of Technology (IIT) Roorkee, India.

Skills and Expertise

- Nanoscale device fabrication in a clean-room environment
- Electron beam lithography (EBL) and optical lithography
- Low temperature transport measurements
- Vacuum systems, thin film deposition (thermal and e-beam evaporation),
- Electrical characterization of semiconductor materials/devices (by I-V and C-V probes)
- Structural and surface characterization (SEM, XRD, and Raman spectroscopy) of materials
- Defects characterization using space charge spectroscopy like DLTS
- Modification of materials properties using energetic ion
- Software packages: LabView, Origin

Research Projects

IUAC New Delhi (2021-24), PI

Title: Study of resistive switching mechanism in ion irradiated ZnO nanorods (Rs. 10 Lakh)

SERB-DST (2017-2020), PI

Title: Electrical field controlled magnetism in semiconductor nanowires (Rs. 18.19 Lakh)

UGC (2017-18), PI

Title: Synthesis of semiconductor nanowires for spintronics (Rs. 6 Lakh)

IUAC New Delhi (2015-18), PI

Title: Ion beam induced modification of transport properties of Mn doped GaAs nanowires (Rs. 6 lakh)

Papers in International Peer Reviewed Journals

Publications on [GoogleScholar](#) (* as cofirst author) **H-index-18**

1. *Coexistence of space charge limited and variable range hopping conduction mechanism in sputter-deposited Au/SiC metal-semiconductor-metal device* Alisha, S. Mourya, N. Singh, Sandeep Kumar, R. Chandra and V. K. Malik **IEEE Transactions on Electron Devices**, 70, 714 (2023).
2. *Fabrication of energy storage EDLC device based on self-synthesized TiO₂ nanowire dispersed polymer nanocomposite films*, C. Devi, R. Swaroop, A. Arya, S. Tanwar, A.L. Sharma, Sandeep Kumar **Polymer Bulletin** 79, 4701-4719 (2022).
3. *Optical and Low-Temperature Magnetocaloric Properties of HoCr_{0.5}Mn_{0.5}O₃ Compound* K. Kanwar, M Vasundhara, Sandeep Kumar, P. Kumar, S.D. Kaushik, N.Panwar **Journal of Superconductivity and Novel Magnetism** 35, 625 (2022).
4. *High sodium ion conductivity in PEO/PVP solid polymer electrolytes with InAs nanofillers* C. Devi, J. Gellanki, H. Pattersson, Sandeep Kumar **Scientific Reports** 11, 20180 (2021).
5. *A comparative study of the structural, optical, magnetic and magnetocaloric properties of HoCrO₃ and HoCr_{0.85}Mn_{0.15}O₃ orthochromites* K. Kanwar, I.Coondoo, M Anas, V. K. Malik, P. Kumar, Sandeep Kumar, P. K. Kulriya, S.D. Kaushik, N. Panwar **Ceramics International** 73, 4186(2021).
6. *Electrical transport properties of InAs nanowires synthesized by a solvothermal method* C. Devi, R. Singhal, K. Silva, W. Paschoal Jr., H. Pettersson, Sandeep Kumar **Nanotechnology** 31, 235709(2020).
7. *Evaluation of carrier density and mobility in Mn ion-implanted GaAs:Zn nanowires by Raman spectroscopy* Sandeep Kumar, G. B. Corrêa Jr., C. Devi, D. Madsen, A. Johannes, C. Ronning, W. Paraguassu, W. Paschoal Jr. and H. Pettersson **Nanotechnology** 31, 205705 (2020).
8. *In-situ study of electrical transport in Pd/n-Si under high energy ion irradiation* H. K. Chourasiya, P. K. Kulriya, N. Panwar, Sandeep Kumar **Semicond. Sci. Technol.** 35, 085004 (2020).
9. *Influence of barrier inhomogeneities on transport properties of Pt/MoS₂ Schottky barrier junction* Neetika, Sandeep Kumar, A. Sanger, H. K. Chourasiya, A. Kumar, K. Asokan, R. Chandra, V. K. Malik **J. Alloys and Compounds** 797, 582 (2019).
10. *Raman characterization of single-crystalline Ga_{0.96}Mn_{0.04}As:Zn nanowires realized by ion-implantation* G. B. Corrêa Jr., Sandeep Kumar, W. Paschoal Jr., C. Devi, D. Jacobsson, A. Johannes, C. Ronning, H. Pettersson and W. Paraguassu **Nanotechnology** 30, 335202 (2019). *
11. *Structural, Electrical, Optical and Magnetic Properties of SmCrO₃ chromites: Influence of Gd and Mn co-doping* N. Panwar, I. Coondoo, S. Kumar, Sandeep Kumar, M. Vasundhara, A. Rao **J. Alloys and Compounds** 792, 1122 (2019).
12. *Analysis of the carrier conduction mechanism in 100 MeV O⁷⁺ ion irradiated Ti/n-Si Schottky barrier structures* H. K. Chourasiya, P. K. Kulriya, N. Panwar, Sandeep Kumar **Nucl. Instr. And Meth. B** 443, 43 (2019).
13. *Lithium doping and photoluminescence properties of ZnO nanorods* N. Shakti, C. Devi, A. K. Patra, P. S. Gupta, and Sandeep Kumar **AIP Advances** 8, 015306 (2018).

14. *Structural, Magnetic, Magnetocaloric and Specific heat Investigations on Mn doped PrCrO₃ Orthochromites* S. Kumar, I. Coondoo, Vasundhara M, Sandeep Kumar; A. Kholkin, N. Panwar **J. Phys. C: Cond. Matter.** 29, 195802 (2017).
15. *Synthesis of CdS and CuS Nanoparticles for Photovoltaic Devices* A. Gurnani, H. Inani, Y. S. Katharria, Sandeep Kumar, **Bionano Frontier** 8, 144 (2015).
16. *Magnetoresistance in Mn ion-implanted GaAs:Zn nanowires* W. P. Jr, Sandeep Kumar, D. Jacobsson, A. Johannes, V. Jain, C. M. Canali, A. Pertsova, C. Ronning, K. A. Dick, L. Samuelson, H. Pettersson **Appl. Phys. Lett.** 104, 153112 (2014).*
17. *Enhanced sputtering and incorporation of Mn in implanted GaAs and ZnO nanowires* A. Johannes, S. Noack, W. Paschoal, Sandeep Kumar, D. Jacobsson, K. Dick, H. Pettersson, L. Samuelson, G. Martines-Criado, M. Burghammer, C. Ronning **J. Phys. D: Appl. Phys.** 47, 394003 (2014).
18. *Magnetic polarons and large negative magnetoresistance in GaAs nanowires implanted with Mn ions* Sandeep Kumar W. P. Jr, A. Johannes, D. Jacobsson, C. Borschel, A. Pertsova, C-H, Wang, M. K. Wu, C. M. Canali, C. Ronning, L. Samuelson and H. Pettersson **NanoLetters** 13, 5079 (2013).
19. *Hopping conduction in Mn ion implanted GaAs nanowires* W. P. Jr, Sandeep Kumar, C. Borschel, P. Wu, C. M. Canali, C. Ronning, L. Samuelson and H. Pettersson, **NanoLetters** 12, 4838 (2012). *
20. *Thermoelectric Characterization of Electronic Properties of GaMnAs Nanowires* P. Wu, W. P. Jr, Sandeep Kumar, C. Borschel, C. M. Canali, C. Ronning, L. Samuelson, H. Pettersson and H. Linke **J. Nanotechnol.** 2012, 480813(2012).
21. *A new route towards semiconductor nanospintronics: highly Mn-doped GaAs nanowires realized by ion-implantation under dynamic annealing conditions* C. Borschel, M. E. Messing, M. T. Borgström, W. Paschoal Jr, J. Wallentin, Sandeep Kumar, K. Mergenthaler, K. Deppert, C. M. Canali, H. Pettersson, L. Samuelson and C. Ronning **NanoLetters** 11, 3935 (2011).
22. *Synthesis of Controlled Diluted Magnetic Semiconductor by Ni Implantation in ZnO Crystal* D. K. Mishra, P. Kumar, Sandeep Kumar, S. Mohapatra, I. Sulania, A. Tripathi, S. Varma, M. K. Sharma, R. Chatterjee and D. Kanjilal **Adv. Sci. Lett.** 2, 324 (2009).
23. *Effects of thermal and athermal processing on the formation of buried SiC layers* Y. S. Katharria, Sandeep Kumar, D. Kanjilal, D. Chauhan, J. Ghatak, U. Bhatta and P. V. Satyam **J. Appl. Phys.** 105, 014301 (2009).
24. *Ion beam patterning of nano-grating on SiC surface* Y. S. Katharria, Sandeep Kumar, A. T. Sharma and D. Kanjilal, **Surf. Coat. Tech.** 203, 2442 (2009).
25. *Effect of ion irradiation on current-voltage characteristics of Au/n-GaN Schottky diodes* V. Baranwal, Sandeep Kumar, A. C. Pandey and D. Kanjilal **J. Alloys and Compounds** 480, 962 (2009).
26. *In-situ current-voltage analysis of Au/GaAs Schottky diode under nitrogen ion irradiation* A.T. Sharma, Shahnawaz, Sandeep Kumar, Y. S. Katharria, P. Kumar and D. Kanjilal **Surf. Coat. Tech.** 203, 2667 (2009).

27. *Ion-beam-induced modification in GeO_x thin films: A phase separation study* Y. Batra, D. Kabiraj, Sandeep Kumar and D. Kanjilal, **Surf. Coat. Tech.** 203, 2415 (2009).
28. *Swift heavy ion irradiation induced defects and electrical characteristics of Au/n-Si Schottky structure* Sandeep Kumar, Y. S. Katharria and D. Kanjilal, **J. Phys D: Appl. Phys.** 41, 105105 (2008).
29. *Setup for in situ deep level transient spectroscopy of semiconductors during swift heavy ion irradiation* Sandeep Kumar, Sugam Kumar, Y. S. Katharria, C. P. Safvan and D. Kanjilal **Rev. of Sci. Instrum.** 79, 056103 (2008).
30. *Influence of 100 MeV oxygen ion irradiation on Ni/Si (100) Schottky barrier characteristics* Sandeep Kumar, Y. S. Katharria and D. Kanjilal, **J. Appl. Phys.** 103, 044504 (2008).
31. *Inhomogeneities in 130 MeV Au ion irradiated Au/n-Si structure* Sandeep Kumar, Y.S. Katharria, Y. Batra and D. Kanjilal, **Appl. Surf. Sci.** 254, 3277 (2008).
32. *Pulsed laser deposition of SiC thin films at medium substrate temperatures* Y. S. Katharria, Sandeep Kumar, R. Prakash, R.J. Choudhary, F. Singh, N. P. Lalla, D. M. Phase, D. Kanjilal, **Thin Solid Films** 516, 6083 (2008).
33. *Point defect creation by low fluence swift heavy ion irradiation-induced low energy electrons in YBa₂Cu₃O_{7-y}* R. Biswal, J. John, D. Behera, P. Mallick, Sandeep Kumar, D. Kanjilal, T. Mohanty, P. Raychaudhuri and N. C. Mishra, **Supercond. Sci. Technol.** 21, 085016 (2008).
34. *Elastic Recoil Detection (ERD) Analysis of GeO_x thin films* Y. Batra, S.A. Khan, D. Kabiraj, Sandeep Kumar and D. Kanjilal, **Nucl. Instr. And Meth. B** 266, 1697 (2008).
35. *Effect of swift heavy ion irradiation on deep levels in Au/n-Si (100) Schottky diodes studied by deep level transient spectroscopy* Sandeep Kumar, Y.S. Katharria, Sugam Kumar and D. Kanjilal, **J. Appl. Phys.** 102, 113709 (2007).
36. *Influence of swift heavy ion irradiation on electrical characteristics of Au/n-Si(100) Schottky structure* Sandeep Kumar, Y.S. Katharria, Y. Batra and D. Kanjilal, **J. Phys. D: Appl. Phys.** 40, 6892 (2007).
37. *Self-organization of 6H-SiC (0001) surface under keV ion Irradiation* Y. S. Katharria, Sandeep Kumar, P. S. Lakshmi, D. Kanjilal and A. T. Sharma, **J. Appl. Phys.** 102, 044301 (2007).
38. *Nano and micro-scale patterning of Si under ion erosion* Y. S. Katharria, Sandeep Kumar, A. T. Sharma and D. Kanjilal, **Appl. Surf. Sci.** 253, 6824 (2007).
39. *Characterizations of pulsed laser deposited SiC thin films* Y. S. Katharria, Sandeep Kumar, R. Prakash, R.J. Choudhary and D. Kanjilal, **J. of Non-Crystalline Solids** 353, 4660 (2007).
40. *Influence of SHI irradiation on the formation of buried SiC* Y. S. Katharria, Sandeep Kumar, and D. Kanjilal, **Nucl. Instru. And Meth. B**, 260, 563 (2007).
41. *Ion-beam-induced phase separation in GeO_x thin films* Y. Batra, D. Kabiraj, Sandeep Kumar and D. Kanjilal, **J. Phys. D: Appl. Phys.** 40, 4568 (2007).

42. *Effect of swift heavy ion irradiation on electrical characteristics of Au/n-GaAs Schottky diodes* A. T. Sharma, Sahanawz, Sandeep Kumar, Y. S. Katharria and D. Kanjilal, **Appl. Surf. Sci.** 254, 459 (2007).
43. *Barrier modification of Au/n-GaAs Schottky diode by swift heavy ion irradiation* A. T. Sharma, Sahanawz, Sandeep Kumar, Y. S. Katharria and D. Kanjilal, **Nucl. Instr. And Meth. B**, 263, 424 (2007).
44. *Temperature dependent barrier characteristics of swift heavy ion irradiated Au/n-Si Schottky structure* Sandeep Kumar, Y.S. Katharria, Sugam Kumar and D. Kanjilal, **J. Appl. Phys.** 100, 113723 (2006).
45. *Synthesis of buried SiC using energetic ion beam* Y. S. Katharria, Sandeep Kumar, F. Singh, J.C. Pivin and D. Kanjilal, **J. Phys. D: Appl. Phys.** 39, 3969 (2006).
46. *Temperature dependence of barrier height of swift heavy ion irradiated Au/n-Si Schottky structure* Sandeep Kumar, Y.S. Katharria, S. Kumar and D. Kanjilal, **Solid State Electron.** 50, 1835 (2006).
47. *Barrier height modification of Au/n-Si Schottky structures by swift heavy ion irradiation* Sandeep Kumar and D. Kanjilal, **Nucl. Instr. And Meth. B**, 248, 109 (2006).