

Curriculum Vitae: Ashish Kumar

DST INSPIRE Faculty,
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Inter-University Accelerator Center,
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RESEARCH INTERESTS

- Thermoelectric materials
- Metal-semiconductor interface
- Defects in semiconductors
- Surface passivation (wet chemical)

PROFESSIONAL EXPERIENCE

DST INSPIRE Faculty

Aug. 2015-Till Date

Inter University Accelerator Center, New Delhi

Research Topic: Defect Assisted Current Transport Mechanism in III-V Semiconductors for Thermoelectric/Energy Applications.

Research Associate

May 2013-Aug. 2015

Inter University Accelerator Center, New Delhi

Research Topic: Study of Defect Evolution in Wide Band-gap Semiconductors due to SHI Irradiation.

Research Adviser: Dr. D. Kanjilal.

Ph.D. in Physics

July 2008- Oct. 2013

Indian Institute of Technology Delhi, New Delhi

Advisor: Dr. Rajendra Singh

Thesis: Study of GaN based Schottky barrier diodes and the effect of swift heavy ion irradiation on their electrical properties (*with a CGPA of 8.25/10*).

EDUCATION

Master of Science (Physics)

June 2007

Kurukshetra University, Kurukshetra, India(*with 64.9%*).

Bachelor of Science (Non-Medical)

June 2005

MDU Rohtak, India(*with 66.82%*).

Higher Secondary (10+2)

March 2002

HBSE, Haryana, India(*with 75.4%*).

Matric (10th)

March 2000

HBSE, Haryana, India(*with 77.5%*).

AWARDS & ACHIEVEMENTS

Selected for 69th Lindau Nobel Laureate Meeting	July 2019
National Eligibility Test for Junior Research Fellowship (NET/JRF) conducted by UGC-CSIR, India	Dec. 2007
Graduate Aptitude Test in Engineering (GATE) conducted by IIT/MHRD India (AIR 460, Percentile 91.97)	Feb. 2008
Joint Entrance Screening Test (JEST) conducted by Premier Research Institutes in India (AIR 196, Percentile 95.48)	Feb. 2008
Selected for Bhabha Atomic Research Centre Training Schools (OCES/DGFS-2008)	Aug. 2008
Best Presentation Award at the GPG College, Narnaul Inter-College Science Exhibition	Sept. 2004
State Topper in VLD Entrance Exam for Chaudhary Charan Singh (C.C.S.) Haryana Agricultural University, Hisar (Haryana)	Aug. 2003
National Means-cum-Merit Scholarship (NMMS) awarded by the National Education Ministry to the best students in state (3 times for 12 th , 10 th and 8 th standard).	Oct. 2002 Aug. 2000 July 1998

PROFESSIONAL SKILLS

- Professional experience:
 - o Worked at class 100 clean room facility for fabrication of devices.
 - o Expertise in transport measurement of in micro/nano devices, Low temperature measurements, DLTS, *I/f* Noise measurement, thermoelectric, DC Probe station and Variable Temp. Hall Setup, etc.
 - o Worked and developed programs in LabView and Testpoint environment.
 - o Sound device physics understanding, GaN, ZnO, 2D materials. Wet Chemical Passivation, Annealing, Ion Irradiation, Vacuum Techniques (VH & UHV)
 - o Experience of AFM/STM (Veeco) (quazar, nanoRev).
 - o Good co-ordination skills in multicultural and cross-disciplinary environment.
- Home-made Facilities Established:
 - o Thermal conductivity, Seebeck coefficient, LN2 cryostat, DLTS, *I/f* Noise measurement.

TEACHING AND ADVISING EXPERIENCE

- Teaching Assistant:
 - o EP110-Engineering Physics at IIT Delhi (Course design, Teaching, Grading & Evaluation).
 - o Currently teaching Semiconductor Physics and Materials Characterizations at IUAC.
- Advised PG and UG Student Projects:
 - o Supervision of ~10 M. Tech, M. Sc. and B. Tech student projects. (List attached)

PROFESSIONAL CONTRIBUTIONS

- Professional Affiliation:
 - o Life Member, Ion Beam Society of India (IBSI)
 - o Life Member, Semiconductor Society of India (SSI)
 - o Life Member, Indian Physics Association (IPA)
- Reviewer:
 - o Applied Physics Letters, Journal of Applied Physics, Semiconductor Science & Technology, Current Applied Physics, Materials Science Engineering B.
- Conference/ School Organization:
 - o School on Characterizations of Materials 2017 at IUAC New Delhi
 - o International School on Ion Beam in Materials Science (IBMS 2016) at IUAC New Delhi.
 - o International Conference on Ion Beam in Materials Engineering and Characterization (IBMEC 2016) at IUAC New Delhi.
- Sponsored Projects
 - o Investigation on thermoelectric properties of GaN with cash grant of ~INR 35 lakh from DST under INSPIRE Faculty scheme to undertake research on thermoelectric device development, Aug 2015 to Aug 2020.

SCIENTIFIC CONTRIBUTIONS & PUBLICATIONS

- Invited/Expert Talk
 - o YMCA University of Science and Technology, Faridabad on Science Day 2016 on title: GaN: technology, applications and future prospects.
 - o RAMST-2017 organized by Amity University, Gurgaon on title: GaN for thermoelectric applications.
 - o IIT (ISM) Dhanbad, Faculty Development Center, two lectures, (19-25 March 2018)
 - o National conference on Changing Trends, Future Challenges & Innovations in Sciences & Technology (CTFCIST -2017) held at A P Goyal Shimla University, Shimla, Himachal Pradesh (25-26th May, 2017) on title: Defect Assisted Current Transport Mechanism in III-V Semiconductors for Thermoelectric/Energy Applications.
 - o School on characterization of materials held IUAC New Delhi (4-9, Sept 2017) on title: Study of Defects Evolution in GaN due to SHI irradiation.
- Patents Issued/filed
 - o **Kumar A.**, Sharma R., Singh J., Behera K., “A system for providing nest id based identification of a geographical location and method thereof”, IN (2015) 44683.
 - o **Kumar A.**, Sengar S.K., “GaN based thermoelectric device”. IN (2018) Filed.
 - o **Kumar A.**, Sengar S.K., “Ga₂O₃ based thin film device for thermoelectric applications at higher temperatures”. IN (2018) Filed.
 - o **Kumar A.**, Sengar S.K., “Ga₂O₃ based device for electricity generation at higher temperatures”. IN (2018) Filed.
- Referred Journals (selected)
 - o **Kumar A.**, Patel A., Singh S., Asokan K. and Kanjilal K., Apparatus for Seebeck coefficient measurement of wire, thin film and bulk materials in the wide temperature range (80 – 650 K), **Review of Scientific Instruments** (in press).
 - o Bhogra A., Masarrat A., Meena R., Hasina D., Bala M., Dong C.L., Chen C.L., Som T., **Kumar A.**, Asokan K., Tuning the electrical and thermoelectric properties by N ion

implantation in SrTiO₃ thin films and their conduction mechanisms, **Scientific Reports** (accepted).

- Kumar P., Sharma V., Singh J.P., **Kumar A.**, Chahal S., Sachdev K., Chae K.H., Kumar A., Asokan K., Kanjilal D., Investigations on magnetic and electrical properties of Zn doped Fe₂O₃ nanoparticles and their correlation with local electronic structure, **Journal of Magnetism and Magnetic Materials**, 2019, 165398.
- Neetika, Kumar S., Sanger A., Chourasiya H.K., **Kumar A.**, Asokan K., Chandra R., Malik V.K., Influence of barrier inhomogeneities on transport properties of Pt/MoS₂ Schottky barrier junction, **Journal of Alloys and Compounds**, 2019, 797, 582-588
- Defect engineering in wide bandgap materials for thermoelectric applications. **Kumar A.** SSI Newsletter, 04/2019, <http://www.ssindia.org.in/images/NewsLetterMarch2019.pdf>
- Tak BR, Garg M, **Kumar A.**, Gupta V, Singh R, Gamma Irradiation Effect on Performance of β -Ga₂O₃ Metal-Semiconductor-Metal Solar-Blind Photodetectors for Space Applications, **ECS Journal of Solid State Science and Technology**, 2019, Q3149-Q3153.
- Masarrat A, Bhogra A, Meena R, Bala M, Singh R, Barwal V, Dong CL, Chen CL, Som T, **Kumar A.**, Niazi A, Asokan K, Effect of Fe Ion Implantation on the Thermoelectric Properties and Electronic Structure of CoSb₃ Thin Films, **Journal of Alloys and Compounds** (accepted).
- **Kumar A.**, Dhillon J., Verma S., Kumar P., Asokan K., and Kanjilal D., Identification of Swift Heavy Ion Induced Defects in Pt/n-GaN Schottky Diodes by in-situ Deep Level Transient Spectroscopy, **Semicond. Sci. Technol.** 2018, 33, 085008.
- **Kumar A.**, Singh R., Kumar P., Singh U.B., Asokan K., Karaseov P.A., Titov A.I., and Kanjilal D., In-situ transport and microstructural evolution in GaN Schottky diodes and epilayers exposed to swift heavy ion irradiation, **Journal of Applied Physics**, 2018, 123, 161539.
- Kumar S., **Kumar A.**, Tripathi A., Tyagi A., and Avasthi D.K., Engineering of electronic properties of single layer graphene by swift heavy ion irradiation, **Journal of Applied Physics** 2018, 123, 161533.
- **Kumar A.**, Dhillon J., Meena R.C., Kumar P., Asokan K., Singh R., and Kanjilal D., Enhancement of thermopower in GaN by ion irradiation and possible mechanisms, **Appl. Phys. Lett.** 2017, 111, 222102.
- Kumar M.V., Kumar S., Cheng C., Asokan K., Kumar A., Shobha V., Karanth S.P., Krishnaveni S., Influence of High Dose Gamma Irradiation on Electrical Characteristics of Si Photo Detectors, **ECS J. Solid State Sci. Technol** 2017, 6 (10), 132-135
- Kumar, P.; Kumar, P.; **Kumar, A.**; Sulania, I.; Chand, F.; Asokan, K., Structural, optical and magnetic properties of N ion implanted CeO₂ thin films. **RSC Advances** **2017**, 7 (15), 91609168.
- Kumar P., Dixit G., **Kumar A.**, Sharma V., Goyal R., Sachdev K., Annapoorni S., Asokan K., Structural, Electrical and Magnetic Properties of dilutely Y doped NiFe₂O₄ Nanoparticles. **Journal of Alloys and Compounds** 2016, 685(0), 492–497.
- Kumar, P.; Sharma, V.; Sarwa, A.; **Kumar, A.**; Shekhawat, S.; Goyal, R.; Sachdev, K.; Annapoorni, S.; Kandasami, A.; Kanjilal, D., Understanding the origin of Ferromagnetism in Er doped ZnO System. **RSC Advances** **2016**, 6 (92), 8924289249.

- Kumar, P.; Kumar, P.; Kumar, A.; Meena, R. C.; Tomar, R.; Chand, F.; Asokan, K., Structural, morphological, electrical and dielectric properties of Mn doped CeO₂. **Journal of Alloys and Compounds** **2016**, (doi:10.1016/j.jallcom.2016.02.153).
- Kumar, T.; Panchal, V.; **Kumar, A.**; Kanjilal, D., Nanopits on GaAs (100) surface: Preferential sputtering and diffusion. **Nuclear Instruments and Methods in Physics Research Section B**: **2016**, (doi:10.1016/j.nimb.2016.03.053).
- **Kumar, A.**; Kumar, P.; Kumar, K.; Singh, R.; Asokan, K.; Kanjilal, D., Role of Growth Temperature on the Structural, Optical and Electrical Properties of ZnO Thin Films. **Journal of Alloys and Compounds** **2015**, (10.1016/j.jallcom.2015.06.218).
- **Kumar, A.**; Kumar, T.; Hähnel, A.; Kanjilal, D.; Singh, R., Dynamics of modification of Ni/nGaN Schottky barrier diodes irradiated at low temperature by 200 MeV Ag¹⁴⁺ ions. **Applied Physics Letters** **2014**, 104 (3), 033507.
- **Kumar, A.**; Kumar, M.; Kaur, R.; Vinayak, S.; Singh, R., Barrier height enhancement of Ni/GaN Schottky diode using Ru based passivation scheme. **Applied Physics Letters** **2014**, 104 (13), 1335101.
- Kumar, M.; **Kumar, A.**; Thapa, S.; Christiansen, S.; Singh, R., XPS study of triangular GaN nano/micro needles grown by MOCVD technique. **Materials Science and Engineering: B** **2014**, 186, 8993.
- **Kumar, A.**; Singh, T.; Kumar, M.; Singh, R., Sulphide passivation of GaN based Schottky diodes. **Current Applied Physics** **2014**, 14 (3), 491495.
- Kumar, T.; **Kumar, A.**; Agarwal, D. C.; Lalla, N. P.; Kanjilal, D., Ion beam generated surface ripples: new insight in the underlying mechanism. **Nanoscale Res Lett** **2013**, 8 (1), 336.
- **Kumar, A.**; Vinayak, S.; Singh, R., Microstructural and temperature dependent electrical characterization of Ni/GaN Schottky barrier diodes. **Current Applied Physics** **2013**, 13 (6), 11371142.
- **Kumar, A.**; Arafim, S.; Amann, M. C.; Singh, R., Temperature dependence of electrical characteristics of Pt/GaN Schottky diode fabricated by UHV e beam evaporation. **Nanoscale Res Lett** **2013**, 8 (1), 481.
- Kumar, T.; **Kumar, A.**; Lalla, N.; Ho oda, S.; Ojha, S.; Verma, S.; Kanjilal, D., Role of ion beam induced solid flow in surface patterning of Si (100) using Ar ion beam irradiation. **Applied Surface Science** **2013**, 283, 417421.
- Kumar, T.; **Kumar, A.**; Kanjilal, D., An approach to tune the amplitude of surface ripple patterns. **Applied Physics Letters** **2013**, 103 (13), 131604.
- **Kumar, A.**; Hähnel, A.; Kanjilal, D.; Singh, R., Electrical and microstructural analyses of 200 MeV Ag¹⁴⁺ ion irradiated Ni/GaN Schottky barrier diode. **Applied Physics Letters** **2012**, 101 (15), 153508.
- **Kumar, A.**; Kanjilal, D.; Kumar, V.; Singh, R., Defect formation in GaN epitaxial layers due to swift heavy ion irradiation. **Radiation Effects and Defects in Solids** **2011**, 166 (89), 739742.
- Dadwal, U.; **Kumar, A.**; Scholz, R.; Reiche, M.; Kumar, P.; Boehm, G.; Amann, M.; Singh, R., Blistering study of H implanted InGaAs for potential hetero integration applications. **Semiconductor Science and Technology** **2011**, 26 (8), 085032.
- Peer Reviewed Conferences Proceedings
 - R. N. Dutt, V. Soni, **A. Kumar**, A. Das, S. Kar, F. Singh, T. S. Datta, “Design of an RMS based Steady State Detector for a Cryogenic Temperature Control Process and Automation of Temperature vs Material Property Characterizations”, **Third IFAC**

International Conference on Advances in Control and Optimization of Dynamical Systems (ACODS 2018), Hyderabad, India, February 18-22, 2018.

- A. I. Titov, P. A. Karaseov, A. I. Struchkov, A. Kumar, R. Singh, D. Kanjilal. Electrical isolation of GaN by 200 MeV Ag ion irradiation” **XXIII International Conference on Ion-Surface Interactions (ISI-2017)**, August 21-25, 2017, Moscow, Russia, Publ.by MEPhI Publishing, vol.2, pp. 120-123.
- **Kumar, A.**; Singh, T.; Kumar, K.; Knez, M.; Singh; R. In Study of the Structural, Electrical and Optical Properties of ZnO Thin Films Grown by ALD at Low Temperatures, **MRS Fall Meeting Symposium M**, Material Research Society: 2011; p 1394 (2011) M10.11.
- **Kumar A.**, M. C. S., Vinayak S., Singh R., In Temperature Dependence of IV Characteristics of Au/GaN Schottky diodes, **International Workshop on Physics of Semiconductor Devices (XV-IWPSD)**, New Delhi, India (Dec 15-19, 2009). IEEE: 2009.
- **Kumar, A.**; Vinayak, S.; Singh; R. In Investigation of Current voltage Characteristics of Ni/GaN Schottky Barrier Diodes, 9th **International Conference on Nitride Semiconductors (ICNS9)**, Glasgow, UK, Wiley Online Library: 2011.
- Kumar P, F. C., Kumar P., R. C. Meena, Kumar A., Asokan K., In Structural and dielectric properties of Cu doped CeO₂, **AIP Conference Proceedings**: 2016; p 020299.
- Kumar, P.; Sharma, V.; **Kumar, A.**; Sachdev, K.; Asokan, K. In Structural, morphological and vibrational properties of Fe₂O₃ nanoparticles, Proceedings of the International Conference on Nanotechnology for Better Living, Research Publishing, Srinagar: 2016; p 163.
- **Kumar, A.**; Vinayak, S. ; Singh, R., Investigation of current voltage characteristics of Ni/GaN Schottky barrier diodes for potential HEMT applications. **Journal of Nano and Electronic Physics 2011**.
- Kumar, A.; **Kumar, A.**; Asokan, K.; Kumar, V.; Singh, R., Temperature dependence of 1/f noise in Gallium Nitride epitaxial layer. **Journal of Nano and Electronic Physics 2011**.
- **Kumar, A.**; Kanjilal, D.; Kumar, V.; Singh, R. In Defect Formation in GaN Epitaxial Layers due to SHI Irradiation, **AIP Conference Proceedings, 2011**; p 1099.
- Conference Presentations (selected):
 - **Ashish Kumar**, Jyotsna Dhillon, R. C. Meena, K. Asokan, D. Kanjilal “Defect Assisted Current Transport Mechanism in III-V Semiconductors for Thermoelectric Applications” **DRIP XVII** Conference 2017 (October 8-12, 2017), Valladolid, Spain
 - **Ashish Kumar**, Trilok Singh, Kaushal Kumar, MatoKnez and R. Singh “Study of the Structural, Electrical and Optical Properties of ZnO Thin Films Grown by ALD at Low Temperatures” **MRS Fall Meeting - Symposium M**, 1394 (2011) M10.11.
 - **Ashish Kumar**, D. Kanjilal, V. Kumar and R. Singh, “Defect formation in GaN epitaxial layers due to SHI irradiation”, **55th DAE-Solid State Physics Symposium (DAE-SSPS)**, Manipal, India.
 - **Ashish Kumar**, SeemaVinayak and R. Singh “Investigation of Current-voltage Characteristics of Ni/GaN Schottky Barrier Diodes” **9th International Conference on Nitride Semiconductors (ICNS-9)**, Glasgow, UK (July 10-15, 2011).
 - **Ashish Kumar**, SeemaVinayak, V. Kumar and R. Singh “Investigation of current-voltage characteristics of Ni/GaN Schottky barrier diodes for potential HEMT

applications” **International Symposium of Semiconductor Materials and Devices (ISSMD)**, Vadodara, India (Jan 28-30, 2011).

- **Ashish Kumar**, D. Kanjilal, V. Kumar and R. Singh “Effect of 200 MeV Ag ion irradiation on the properties of GaN epitaxial layers” **Conference on Swift Heavy Ions in Materials Engineering and Characterization (SHIMEC)**, New Delhi, India (Oct 6-9, 2010).
- **Ashish Kumar**, M. Chandra Sekhar, SeemaVinayak, and R. Singh “Temperature Dependence of I-V Characteristics of Au/GaN Schottky diodes” **International Workshop on Physics of Semiconductor Devices (XV-IWPSD)**, New Delhi, India (Dec 15-19, 2009).

REFERENCES

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New Delhi
July. 01, 2019

Sincerely,
Ashish Kumar