

Dr. DILIP KUMAR SINGH

Research Scholar

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Objective:

To obtain a post-doc position in the field of Nanotechnology/ Spectroscopy/ Ion-beam modification of materials Electron microscopy for perusing a research career contributing to fundamental physics and having sound technological applications.

Personal Information:

Age and Date of Birth: 28 years,
10th May 1982.

Gender: Male

Marital status: Married

Religion and Nationality: Hindu, Indian

Languages Known: Hindi, English



Educational Qualification:

Exam	College	University / Board	Year	% of marks, Division
Ph.D (Tech.) (NanoScience and Nanotechnology)	Centre for Nanotechnology	Indian Institute of Technology Guwahati, Guwahati-781039	2011	Pre-Ph.D coursework CGPA 8.25 / 10.
Master of Science (Spl. Cond. Matt. Phy)	P.G.Deptt. of Physics, Ranchi University	Ranchi University, Ranchi	2005	62.75 1st
Bachelor of Science (Phy-Honors)	St.Xavier's college, Ranchi	Ranchi University, Ranchi	2002	68.62 1st
HSC (I.SC)	St.Xavier's college, Ranchi	B.I.E.C, Patna	1999	64.88 1st
SSC (Matric)	St.John's H/s school, Ranchi	B.S.E.B, Patna	1997	64.77 1st

Other Academic Qualifications:

1. Certificate in Disaster Management, December-2001, Indira Gandhi National Open University (India) with 72 % marks.
2. Diploma in Computer Applications, May-2002, Sterlite Foundation, Mumbai (India).

National Eligibility tests qualified: GATE- 2005, JEST- 2005, CSIR SRF 2008.

Ph. D Under Joint Supervision of

Dr. P. K. Giri
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Dr. P. K. Iyer
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Title of Ph.D Thesis: “Spectroscopic studies of diameter dependent properties, defects and defect engineering in single-walled and multi-walled carbon nanotubes”

Research Interests and Present work:

Presently I am working on defect induced spectroscopic properties of carbon nanotubes (CNTs). My interest lies in modification of electronic band structure of CNTs due to various types of structural defects and its spectroscopic signatures in Raman, photoluminescence and electron paramagnetic resonance spectroscopy (EPR). I use Transmission electron Microscope (TEM) to image the naturally occurring and chemically generated structural defects. I have experimentally explored the possibility of controlled modification of properties of CNTs using energetic ion and electron beams. I have studied the diameter dependence of interwall separation and strain in multiwalled carbon nanotubes using X-ray diffraction and Raman scattering studies.

I have strong interest in design and development of scientific equipments. I have assembled dispersive Raman spectrometer, fabricated high temperature furnaces and designed and developed Chemical Vapor deposition system (PECVD) for CNTs growth. I possess expertise on high vacuum equipments and have developed home made high vacuum systems for thin film growth, characterization and nanomaterial synthesis. I have also acquired skill for routine measurement and maintenance of analytical equipments, particularly Powder X-ray Diffractometer, Scanning electron Microscope, Transmission Electron Microscope (TEM), Confocal Laser Scanning Microscope, Thermogravimetric analyzer (TGA/DTA), Uv-Vis-NIR absorption spectrometer, Photoluminescence Spectrometer, Raman Spectrometer, Time-Resolved Photoluminescence Spectrometer (TRPL), Electron Spin Resonance spectrometer. I have used physical vapor deposition system like Thermal evaporation, E-beam evaporation and DC / RF sputtering for deposition of thin films.

As a part of group effort I have studied behavior of CNTs in conducting polymer matrices. I have explored the photo-degradation and thermal stability of conducting polymers using various spectroscopic and microscopic tools. I have worked on two more type of semi-conducting materials Zinc oxide and Germanium Nanowires. I have explored the optical properties and role of structural defects in these one dimensional nanostructures.

Fellowships / Awards:

1. July 2005- July 2007, Junior Research Fellowship, MHRD Govt. of India.
2. July 2007- September 2008, (offered till 2010) Senior Research Fellowship, MHRD Govt. of India.
3. October 2008- September 2010, Senior Research Fellowship, Council for Scientific and Industrial Research (CSIR), Govt. of India.

Technical Skills:

Design and Development of Instruments

- Raman spectrometer (Dispersive Raman Assembled in lab)
- Chemical Vapor Deposition System (CVD)
Design and developed Gas phase chemical vapor deposition (CVD) system for Carbon nanotube growth.
- High temperature Furnaces equipped with High vacuum systems.
- Vacuum systems (Expertise in Vacuum system design and instrument design using rotary, diffusion pumps, turbo-molecular pump, Sputter ion pumps)

Physical Vapor Deposition systems

- Thermal Evaporation system
- E-beam Deposition system
- DC and RF Magnetron sputtering system (metallic and dielectric materials)
- Chemical Vapor Deposition system (CVD)

Lithography and Ion-implantation

- UV-Photolithography
- E-beam lithography,
- Nanostructures fabrication using focused ion beam technique.
- Ion-implantation of materials.

Analytical Instruments (Expertise in measurement, analysis and maintenance)

Microscopy

- Scanning electron microscopy (SEM) and Energy dispersive X-ray spectroscopy (EDX)
- Transmission electron microscopy (TEM), High resolution electron microscopy (HRTEM) imaging for lattice defect studies, Electron diffraction (SAD, CBED). TEM Sample preparation using ion beam milling, Use of microtome.
- Confocal Laser Fluorescence Scanning Microscope (CLFSM)

Spectroscopy

- UV-Vis-NIR absorption spectroscopy
- Photoluminescence spectroscopy (Visible and NIR range both) Also LN₂ temperature measurements.
- Time-Resolved Photoluminescence spectroscopy (TRPL)
- FTIR spectroscopy.
- Raman Spectroscopy
- Electron Spin Resonance Spectroscopy (ESR), (also at low temperatures.)
- X-ray Photoelectron spectroscopy (XPS)

Others

- Powder X-ray diffractometry (XRD)
- Thermogravimetric (TGA & DTA) and Differential scanning calorimetry (DSC).
- Dynamic light scattering (DLS)
- Vibrating Sample Magnetometer (VSM)

Computational Skills

- Matlab, MathCAD, C-programming, Origin, Sigma Plot, Electron microscopy image processing, Spectral deconvolution.

Publications:

Carbon Nanotubes:

1. **Dilip K. Singh**, Parameswar .K. Iyer, and P. K. Giri, *“Diameter dependent oxidative stability of multiwalled carbon nanotubes: Role of defects and effect of vacuum annealing”*, **J. Appl. Phys.** **108**, 084313 (2010).
(Also appeared in **Virtual Journal of Nanoscale Science & Technology**, November 1, 2010)

2. **Dilip K. Singh**, Parameswar .K. Iyer, and P. K. Giri, “*Diameter dependent spectral features in X-ray diffraction & Raman scattering of multi-walled carbon nanotubes: Interlayer interactions and curvature effects*”, **Diamond and Related Materials** **19**, 1281 (2010).
3. **Dilip K. Singh**, Parameswar .K. Iyer, and P. K. Giri, “*Defect evolution and structural improvement in low energy ion irradiated carbon nanotubes: Microscopic and spectroscopic studies*”, **Int. J. Nanosci.** (2011). DOI: 10.1142/S0219581X11007661
4. **Dilip K. Singh**, Parameswar .K. Iyer, and P.K.Giri, “*Quantitative analysis of diameter dependent properties of multi-walled carbon nanotubes*”, **AIP Conference Proceedings**, Vol. **1147**, 450-456, 2009.
5. **Dilip K. Singh**, P. K. Iyer, and P. K. Giri, “*Optical Signature of Structural Defects in Single Walled and Multiwalled Carbon Nanotubes*” **J. Nanosci. Nanotechnol.** **9**, 5396 (2009).
6. **Dilip. K. Singh**, P. K. Iyer, and P. K. Giri, “*Functionalization of Carbon nanotubes and study of its optical and structural properties*” **Nano Trends, A Journal of Nanotechnology and Its Applications**” **4**, 55 (2008).
7. P. K. Giri and **Dilip K. Singh** “*Possible role of defects in the Visible Photoluminescence from Single Walled and Multiwalled Carbon Nanotubes*” **Mater. Res. Soc. Symp. Proc. Vol. 1018**, EE07-03 (2007)
8. **Dilip. K. Singh**, P.K.Iyer, and P. K. Giri, “*Study of fluorescence quenching effect of Carbon Nanotubes.*” **Proc. 52nd DAE Solid State Physics Symposium**, Ed. Amitabh Das, Meenakshi Sunder and Shiv Kumar Gupta, Vol. **52**, 2007, p.347.

Graphene:

9. **Dilip K. Singh**, Parameswar K. Iyer and P. K. Giri “*Improved chemical synthesis of graphene using a safer solvothermal route*” **Int. J. Nanosci.** (2011) DOI: 10.1142/S0219581X11007636.

Zinc Oxide and Nanowire:

10. P. K. Giri, S. Bhattacharya, B. Chetia, Satchi Kumari, **Dilip. K. Singh**, P. K. Iyer “*High yield chemical synthesis of hexagonal ZnO nanoparticles and nanorods with excellent optical properties*” **J. Nanosci. Nanotechnol.** (In Press, 2009).
11. P. K. Giri, S. Bhattacharyya, **Dilip K Singh**, R. Kesavamoorthy, B. K. Panigrahi, and K.G. M. Nair “*Correlation between microstructure and optical properties of ZnO nanoparticles synthesized by ball milling*” **J. Appl. Phys.** **102**, 093515 (2007).

12. P. K. Giri, P. K. Patel, C. J. Panchal, S. Bhattacharyya, Satchi Kumari, **Dilip K. Singh**, V. A. Kheraj, N. M. Shah, et.al. "*Studies on Zinc Oxide Nanorods Grown Electron Beam Evaporation Technique*" **Synthesis and Reactivity in Inorganic, Metal-Organic, and Nano-Metal Chemistry** **37**, 437 (2007).
13. Prabhakar P. Palni, Satchi Kumari, Neeraj Garg Baruah, **Dilip K Singh**, P K Giri "*Effect of annealing on high quality Zinc Oxide Nanowires synthesized by catalytic vapor-deposition*" **Nano Trends** **3** (2007) 1–6.

Germanium:

14. Satchi Kumari, **Dilip K Snigh**, and P. K. Giri, "*Strain Anisotropy in Freestanding Germanium Nanoparticles Synthesized by Ball Milling*" **J. Nanosci. Nanotechnol.** **9**, 5231 (2009).

Polymer:

15. Prasanta J. Goutam, **Dilip K. Singh**, P. K. Giri, Parameswar K. Iyer, "*Enhancing the Photo Stability of Poly-(3-Hexylthiophene) by Preparing Composites with Multiwalled Carbon Nanotubes*", **J. Phy. Chem. B**, **115** (2011) 919.
16. P. K. Reddy, P. J. Goutam, **Diilp. K. Singh**, A. K. Ghoshal,; P. K. Iyer, "*Poly(3-hexylthiophene) to fullerenes. Kinetic modeling and analysis of thermal degradation pathway*" **Polymer degradation and stability** **94**, 1839 (2009).

Communicated / under preparation:

17. **Dilip K. Singh**, Parameswar K. Iyer, and P. K. Giri, "*Defect mediated efficient quenching of fluorescence of fluorescent dyes by single walled carbon nanotubes*" (Under Review, **Appl. Phys. Lett.**).
18. **Dilip K. Singh**, Parameswar .K. Iyer, and P. K. Giri, "*Low energy Ar⁺ ion irradiation improvement in structural and optical properties of single-walled carbon nanotubes*", (Communicated).
19. **Dilip K. Singh**, Parameswar .K. Iyer, and P.K.Giri, "*Spectroscopic study of low energy N⁺ ion-irradiation induced structural defects and transformations in carbon nanotubes*", (Communicated).
20. **Dilip K. Singh**, Parameswar K. Iyer and P. K. Giri "*Defect Evolution and Structural Improvement in Low energy ion irradiated Carbon Nanotubes: Microscopic and Spectroscopic Studies*"
21. **Dilip K. Singh**, Parameswar K. Iyer, and P.K.Giri, "*Effect of ion species on the structural modification of low- energy ion-irradiated carbon nanotubes*".
22. **Dilip K. Singh**, Parameswar K. Iyer, and P. K. Giri, "*Interaction of carbon nanotubes with fluorophores : Photoluminescence and Adsorption studies*"

Conference Presentations:

1. *"Identification of Defect Induced Intermediate Frequency Modes in Raman Spectrum of Single Walled Carbon Nanotubes"* Dilip K. Singh, Parameswar K. Iyer and P. K. Giri, **International Conference on Materials for Advanced Technologies (ICMAT-2011)**, Singapore, June 28-July 1, 2011. Accepted (**Oral Presentation**)
2. **Dilip K. Singh**, Parameswar K. Iyer and P. K. Giri *"Spectroscopic studies of structural defects and Raman vibrational modes of low energy ion-irradiated carbon nanotubes"* **International Conference on Perspectives in vibrational spectroscopy (ICOPVS-2010)**. Banaras Hindu University, Varanasi, India. February 21-24, 2009, (**Oral Presentation**)
3. Prasanta J. Goutam , P. Karthik Reddy, **Dilip K. Singh**, Alope K. Ghoshal and Parameswar K. Iyer, *"Poly(3-hexylthiophene) degrades to fullerene: A Study to ascertain thermal degradation pathway"* **Proc. International Conference on Nanoscience and Technology (ICONSAT-2010)**, IIT Mumbai , February 17-20, 2010. (**Poster Presentation**)
4. P. K. Giri, Prabhakar Palni, and **Dilip K. Singh**, *"Effect of ZnO Seed Layer on the Catalytic Growth of ZnO Multipods and Aligned ZnO Nanorods"* **7th International Nanotechnology Symposium - New Ideas for Industry**, May 26- 27, 2009, Dresden, Germany (**Poster Presentation**)
5. P. K. Giri, Satchi Kumari, **Dilip K. Singh**, *"Microstructure and optical properties of Ge/GeO₂ core-shell nanoparticles synthesized by ball milling"*, **2nd International Conference on Frontiers in Nanoscience and Technology (Cochin Nano 2009)** Jan 4-6, 2009. (**Poster Presentation**)
6. **Dilip K. Singh**, Parameswar K. Iyer and P. K. Giri, *"Low energy Ar⁺ ion irradiation induced improvements in structural and optical properties of single walled carbon nanotubes"*, **International Conference on Transport and Optical Properties of Nanomaterials (ICTOPON-2009)** January, 5th -8th, 2009 University of Allahabad, India. (**Poster Presentation**)
7. Prasanta J. Goutam, **Dilip K. Singh**, Parameswar K. Iyer *"Photostability of Poly(3- hexylthiophene) and multiwalled carbon nanotube composites"* October, 12th-17th, 2008 **Third International Conference on electroactive polymers: Materials & Devices (ICEP-2008)** Jaipur, India. (**Poster Presentation**)
8. P. K. Giri, **Dilip K. Singh**, R. Kesavamoorthy, B. K. Panigrahi and K. G. M. Nair *"Correlating the Microstructural and Photoluminescence Properties of ZnO Nanoparticles Prepared By Ball Milling"*, **Proc. 14th International Workshop on Physics of Semiconductor Devices, Mumbai, India.** Dec 16-20, 2007. (**IEEE Proc. 2007**). p. 905-908 (DOI 10.1109 /IWPSD.2007. 4472669). (**Poster Presentation**)
9. **Dilip K. Singh**, Parameswar K. Iyer and P. K. Giri, *"Improved chemical synthesis of multiwalled carbon nanotubes"* **Proc. International Conference on Advanced Nanomaterials (ANM2007)**, Jan 2007, Mumbai, India. (**Poster Presentation**)

10. Prabhakar Palni, Sachi Kumari, **Dilip K Singh**, R.V.M. Naidu and P K Giri, "*Effect of growth conditions on the structural and optical properties of ZnO thin films grown by RF sputter deposition*" **10th International Conference on Advanced Materials (ICAM 2007), Bangalore, India.** Oct 8-13, 2007. (*Poster Presentation*)
11. **Dilip. K. Singh**, Parameswar K. Iyer, and P. K. Giri, "*Functionalization of Carbon nanotubes and study of its optical and structural properties*" **International conference on Nanotechnology Materials and Methods (CIT-NANOTECH 2006)** 23rd-25th June, 2006, Coimbatore, India. (*Oral Presentation*)
12. **Dilip. K. Singh**, P. K. Giri and R. Kesavamoorthy "*Visible photoluminescence from single walled and multiwalled carbon nanotubes: Role of impurities*" **Eighth International Conference on Nanostructured Materials**, August 20-25, 2006, **Bangalore, India** (*Poster Presentation*)

Schools Attended:

1. Workshop on *chemometrics / Techniques in Vibrational spectroscopy* 20th Feb, 2010. Banaras Hindu University, Varanasi, India.
2. Workshop on *Materials science and Atomic / Molecular physics experiments using the Low energy in beam facility (LEIBF-2009)*. Inter University Accelerator centre (IUAC), New Delhi-110067. 9-10th July, 2009. (Oral Presentation for ion-beam time).
3. National workshop on *plasma-surface interactions and processing (NWPSIP-09)* 25-27th May, 2009.
4. *4th DST Advanced School on Nanoscience and Technology (ASNT-2009)*, 12-24th January, 2009. S. N. Bose centre for Basic Sciences Kolkata, India.
5. Short term course on "*Nanomaterials and Nanoengineering*" 23-27th July, 2008. Indian Institute of Technology Guwahati, Guwahati, India. Quality Improvement programme (QIP) sponsored by AICTE.
6. International workshop on *The physics of Zero and One Dimensional Nanoscopic systems*, 1-9 February, 2006. Saha Institute of Nuclear Physics, Kolkata, India.
7. Training programme organized by National MST Radar facility center, Tirupati, Department of Space, Govt. of India On the Topic "*Atmospheric Science and Atmospheric remote sensing techniques*" 2004.

Awaiting for your favorable reply,

Dilip Kumar Singh

References:

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4. Prof. S. N. Singh

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