CV

Sreyan Raha

Education and training:

Ph.D Thesis Dissertation (Thesis submitted)

August, 2016-May, 2022: Ph. D in experimental condensed matter physics
University: Bose Institute/ University of Calcutta
Title of the thesis: Vibrational and Optical Properties of Semiconductor Nanostructured Materials using Raman and Optical Spectroscopy.
Supervisor: Prof. Achintya Singha,
Department of Physics, Bose Institute, Kolkata, India 700009.

Abstract of the Ph.D. thesis:
The thesis aims to study optical and vibrational properties of 1D and 2D semiconductor systems mainly using Raman and Photoluminescence spectroscopy. Like plasmonic nanostructure, we realized electric field enhancement in germanium nanowire. Depending on the diameter of the nanowire and wavelength of incident radiation, we demonstrated dipolar (antenna effect) and quadrupolar resonance through a polarized Raman study. For the first time, we explored complete lattice dynamics of polymorph ST12 germanium nanowire through Raman spectroscopy and calculations. A systematic Raman study has been carried out to explore the lattice dynamics of the direct bandgap $Ge_{1-x}Sn_x$ alloy nanowire. Our study also involves probing anomalous phonon behavior of SnSe nanoribbon at various thermodynamic conditions. Finally, we demonstrate tuning optical properties of the Mn-doped $MoSe_2$ 2D sheet through photoluminescence spectroscopy.

Master Degree (2 years):

2014-2016: M. Sc in Physical Sciences
University: Bose Institute/ University of Calcutta.
Kolkata, West Bengal, India.

M.Sc. dissertation: Enhanced Raman Scattering from Individual Germanium Nanowire.
Supervisor: Prof. Achintya Singha,

Department of Physics, Bose Institute, Kolkata 700009.
Percentage: 72.80 (First Class)

Bachelor's degree (3 years)

2011-2014: **B. Sc in Physics**
College/ University: Krishnagar Govt. College, University of Kalyani.
West Bengal, India.
Major subject: Physics.
Other subjects: Chemistry, Mathematics.
Percentage: 84% (First class)

Professional Skill Set

Sample Preparation

- ✓ Exfoliation from single crystal.
- ✓ Chemical Vapour Deposition.
- ✓ Hydrothermal method.

Characterization

- ✓ XRD
- ✓ Scanning Electron Microscopy
- ✓ Transmission Electron Microscopy
- ✓ X-Ray Photoelectron Spectroscopy

Vibrational and optical spectroscopy

- ✓ Micro Raman spectroscopy (Polarized Raman spectroscopy, Temperature dependent Raman spectroscopy).
- ✓ Optical absorption spectroscopy.
- ✓ Micro Photoluminescence spectroscopy (ambient, low and high temperature).

Simulation

- ➢ Origin Lab.
- ➢ Microsoft Excel.
- ➢ COMSOL Multiphysics.
- ➢ Mathematica

Personal skills and competences:

Literary works, both fiction and non-fiction, particularly in my mother tongue deeply attract me. As extracurricular, I am involved in writing for magazines and editing books. I have interest in

music as well, and got training in Indian music, with a wish to explore different music genres across the world. I worked as an honorary creative head for a publishing house, which publishes books of literature in Bengali.

Languages known: English, Bengali (Mother tongue).

Conferences and workshops attended

- Oral presentation at QMAT 2020, S N Bose National Centre for Basic Sciences, India.
- Poster presentation at IWPSD 2019, S N Bose National Centre for Basic Sciences, India.
- Poster presentation at ICOPVS 2018 at Bhaba Atomic Research Centre, Mumbai, India.
- Poster presentation at NAWCMP 2018 at Visva Bharati University, India.
- Poster presentation at RTCMP 2017 at Bose Institute., India.
- Poster presentation at ABSMSNW 2017 at IIT BHU, Baranasi, India.

Recognition

- **Prof. Shyamadas Chatterjee Outstanding Student Award, 2021 by Bose Institute, Kolkata.**
- UGC-National Eligibility Test (NET) June 2016 conducted by Govt. of India.
- Qualified Joint Entrance Screening Test (JEST) 2016 conducted by the Science & Engineering Research Board (SERB), Govt. of India, All India Rank: 161.
- Qualified Graduate Aptitude Test in Engineering (GATE) 2016 conducted by Indian Institute of Technology (IITs), All India Rank: 202.
- INSPIRE Scholarship 2011 offered by Department of Science and Technology, Govt. of India.

Referees

Professor Achintya Singha
Ph.D. Thesis supervisor
Bose Institute, Kolkata, India.

Professor Justin D. Holmes
Collaborator
School of Chemistry & Advanced Materials and Bioengineering Research (AMBER) Centre,
University College Cork,
Cork T12 YN60, Ireland

Dr. Subhajit Biswas
Collaborator
School of Chemistry & Advanced Materials and Bioengineering Research (AMBER) Centre,
University College Cork,

Cork T12 YN60, Ireland

Dr. Prabir Pal
Collaborator
Principal Scientist
CSIR-Central Glass & Ceramic Research Institute, Kolkata, India.

Dr. Kaustuv Das
Collaborator
Assistant Professor
Jadavpur University, Kolkata, India

Publications

Thesis Publications

1. **Raha S,** Biswas S, Mondal P K, Doherty Jessica, Holmes J D., Singha A**,** Lattice dynamics in $Ge_{1-x}Sn_x$ alloy nanowires, ***Nanoscale***, 2022,**14**, 7211-7219

2. **Raha S**, Srivastava D, Biswas S, Garcia-Gil A, Karttunen A J., Holmes J D, Singha A, Probing lattice dynamics in ST 12 phase germanium nanowires by Raman spectroscopy, ***Applied Physics Letters*** 119 (23), 232105 (2021).

3. **Raha S**, Mitra S, Mondal P K, Biswas S, Holmes J D, Singha A, Probing dipole and quadrupole resonance mode in non-plasmonic nanowire using Raman spectroscopy**,** ***Nanotechnology*** 31 (42), 425201 (2020).

4. Tanner D. S. P***.,** **Raha S*,** Biswas S, Doherty Jessica, Holmes J D., Singha A, Broderick C A**,** Raman spectroscopy of group-IV $Ge_{1-x}Sn_x$ alloys: theory and experiment, (submitted to ***Phys. Rev. Materials***). * co-first author (Referee report received).

5. **Raha S et.al**, Tunable optical properties of Mn doped $MoSe_2$, (submitted to ***Nano Lett.***).

6. **Raha S et.al,** Temperature dependent anomalous phonon behavior of SnSe nanoribbon, (under preparation).

Other Publications:

1. Singh Bisht R., Chatterjee S., **Raha S**, Singha A., Kabiraj D., Kanjilal D., and Raychaudhuri A. K., Disorder-induced crossover of Mott insulator to weak Anderson localized regime in an argon-irradiated $NdNiO_3$ film, ***Phys. Rev. B*** 105, 205120 (2022).

2. Garcia A, Biswas S, Roy A, Saladukha D, **Raha S**, Blon T, Conroy M, Nicolosi V, Singha A, Lise-Marie Lacroix, Holmes J. D., Growth and Analysis of the Tetragonal (ST12) Germanium Nanowires, ***Nanoscale***, 2022,**14**, 2030-2040.

3. Garcia A, Biswas S, McNulty D, Roy A, **Raha S**, Trabesinger S, Nicolosi V, Singha A, Holmes J, One-step Grown Carbonaceous Germanium Nanowires and their Application as Highly-efficient Lithium-ion Battery Anodes, ***ACS Appl. Energy Mater.*** 2022, 5, 2, 1922–1932.

4. Davitt F, Rahme K, **Raha S**, Garvey S, Gutierrez M, Singha A, Chang S, Biswas S, Holmes J D, Solution phase growth and analysis of super-thin zigzag tin selenide nanoribbons, ***Nanotechnology***, 13 (33), 135601 (2022).

5. Das L, Ray S, **Raha S**, Dey D, Sen K, Aqueous biphasic system in differential extraction of arseno and phospho molybdenum blue: Consequent sensing of glutathione in acid-free medium, ***Colloids and Surfaces A: Physicochemical and Engineering Aspects***, Volume 611, 2021, 125808 (2021).

6. Chakraborty A, Das A, **Raha S**, Barui A, Size-dependent apoptotic activity of gold nanoparticles on osteosarcoma cells correlated with SERS signal, ***Journal of Photochemistry and Photobiology B: Biology***, 111778 (2020).

7. Pariary R, Ghosh B, Bednarikova Z, Varnava K G, Ratha B N, **Raha S**, Bhattacharyya D, Gazova Z, Sarojini V, Mandal A K, Bhunia A, Targeted inhibition of amyloidogenesis using a non-toxic, serum stable strategically designed cyclic peptide with therapeutic implications, ***Biochimica et Biophysica Acta (BBA)-Proteins and Proteomics*** 1868 (5), 140378 (2020).

8. Ratha B N, Kar Rajiv K, Bednarikova Z, Gazova Z, Kotler S A, **Raha S**, De S, Maiti N C, Bhunia A, Molecular Details of a Salt Bridge and Its Role in Insulin Fibrillation by NMR and Raman Spectroscopic Analysis, ***The Journal of Physical Chemistry B*** 124 (7), 1125-1136 (2020).

9. Doherty J, Biswas S, McNulty D, Downing C, **Raha S**, O'Regan C, Singha A, O'Dwyer C, Holmes J D, One-step fabrication of GeSn branched nanowires, ***Chemistry of Materials*** 31 (11), 4016-4024 (2019).

10. Ghosh A, **Raha S**, Dey S, Chatterjee K, Roy Chowdhury A, Barui A, Chemometric analysis of integrated FTIR and Raman spectra obtained by non-invasive exfoliative cytology for the screening of oral cancer, ***Analyst*** 144 (4), 1309-1325 (2019).

11. Ratha B N, Kar R K, Kalita S, Kalita S, **Raha S**, Singha A, Garai K, Mandal B, Bhunia A, Sequence specificity of amylin-insulin interaction: a fragment-based insulin fibrillation inhibition study, ***Biochimica et Biophysica Acta (BBA)-Proteins and Proteomics*** 1867 (4), 405-415 (2019).

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