# Ahin Roy

# Curriculum Vitae

#### Experience

	Experience
	<b>Assistant Professor</b> , Materials Science Centre, IIT-Kharagpur, India. Research area: synthesis, simulation and atomic-scale electron microscopy of nanomaterials
•	<b>Research Fellow</b> , Advanced Microscopy Laboratory, Trinity College Dublin, Ireland. Worked on atomic-scale electron microscopy of nanomaterials for energy applications
	Research Associate, Indian Institute of Science, Bangalore, India.  Worked on computation, synthesis and electron microscopy of functional nanomaterials
•	<b>JSPS Postdoctoral Fellow</b> , Kyushu University, Fukuoka, Japan. Worked on functional nanomaterials using aberration-corrected transmission electron microscopy
_	Integrated Ph. D Research Fellow, Materials Research Centre, Indian Institute of Science, Bangalore, India.  Worked on synthesis, characterization and simulations of metal nanowires
	Ph. D Thesis

#### Awards

2017 Best Poster Award, International Conference and Annual Meeting of Electron Microscope Society of India, Mahabalipuram, Chennai

Title Investigations of Structural and Electronic Aspects of Ultrathin Metal Nanowires

- 2015 Young Scientist Award in Physics, Dr. K. V. Rao Scientific Society, Hyderabad
- 2015 JSPS Postdoctoral Fellowship, MEXT Japan (2015-2017)
- 2014 Gold Award, Shell India Computational Talent Prize
- 2012 Unilever-RSC Science Communication Scholarship, Imperial College, London
- 2009 Integrated Ph. D fellowship, Indian Institute of Science, Bangalore (2009-2016)
- 2002 Certificate of distinction, International Australian Mathematics Olympiad

#### Education

- 2009–2011 **Masters of Science**, Indian Institute of Science, Bangalore. First Class
- 2006–2009 Bachelor of Science, Ramakrishna Mission Residential College, Narendrapur,
   University of Calcutta.
   First Class Honours in Chemistry

# Skills and Expertise

- Electron Proficient in working with FEI T20 and F30 TEMs for regular imaging, FEI TI-Microscopy TAN Themis, JEOL-ARM, and Nion UltraSTEM200 for atomic-scale STEM and associated energy dispersive X-ray spectroscopy (EDS) and electron energy loss spectroscopy (EELS).
- Simulation Density Functional Theory (DFT) based simulation of functional nanomaterials VASP and SIESTA codes: proficient in installation on parallel architecture clusters, execution and analysis.
- Synthesis Wet-chemistry using hydrothermal and microwave methods, characterization using XRD, UV-vis spectroscopy, and electrochemistry using cyclic voltammetry.

# Projects & Funding

- 2022–2024 Atomic-scale Structural and Electronic Interrogation of Symmetry-broken Noble Metal Nanostructures for Oxygen Reduction; PI, SERB Startup Research Grant (SRG), India
- 2019–2021 Engineering photoluminescence of Tungsten Sulfide through Doping and Electrical Biasing; Co-Pl, DST-JSPS Bilateral Research Funding, India & Japan
- 2015–2017 Three-dimensional nanoanalyses of catalytic nanocomposite by electron tomography; Fellow, JSPS Standard Postdoc Program, Japan

#### **Publications**

- [38] L. Hughes,\*<sup>‡</sup> A. Roy,\*<sup>‡</sup> C. Downing, M. P. Browne, A. Zhussupbekova, I. Shvets and V. Nicolosi;\* Surface Reduced Manganese States as a Source of Oxygen Reduction Activity in BaMnO<sub>3</sub>; Advanced Functional Materials (in press)
- [37] S. Pinilla, S. Ryan, L. McKeon, M. Lian, S. Vaesen, A. Roy, J. N. Coleman, and V. Nicolosi; Additive manufacturing of Li-ion batteries: A comparative study between electrode fabrication processes; Advanced Energy Materials (in press)
- [36] D. Tyndall, M. Craig, L. Gannon, C. McGuinness, N. McEvoy, A. Roy, M. García-Melchor, M. P. Browne and V. Nicolosi; Demonstrating the Source of Inherent Instability in NiFe LDH Based OER Electrocatalysts; Journal of Materials Chemistry A, 11, 4067-4077 (2023)
- [35] O. Ronan,\* A. Roy,\* S. Ryan, L. Hughes, C. Downing, L. Jones and V. Nicolosi;\* Templated synthesis of SiO<sub>2</sub> nanotubes for lithium-ion battery applications: an in-situ (Scanning) Transmission Electron Microscopy study; ACS Omega, 8, 1, 925-933 (2023)
- [34] H. Kaur, B. Konkena, C. Gabbett, R. Smith, M. McCrystall, R. Tian, A. Roy, T. Carey, V. Vega-Mayoral, V. Nicolosi, J. N. Coleman; Amorphous 2D-Nanoplatelets of Red Phosphorus Obtained by Liquid-Phase Exfoliation Yield High Areal Capacity Na-Ion Battery Anodes; Advanced Energy Materials, 2203013 (2022)
- [33] A. Garcia-Gil, S. Biswas, D. McNulty, A. Roy, K. M. Ryan, V. Nicolosi and J. D.

- Holmes; High aspect-ratio Germanium-Tin Alloy Nanowires: Potential as Highly Efficient Li-Ion Battery Anodes; Advanced Materials Interfaces, 2201170 (2022)
- [32] B. Konkena, H. Kaur, R. Tian, C. Gabbett, M. McCrystall, D. Horváth, K. Synnatschke, A. Roy, R. Smith, V. Nicolosi, M. D. Scanlon and J. N. Coleman; Liquid Processing of Interfacially Grown Iron-Oxide Flowers into 2D-Platelets Yields Lithium-Ion Battery Anodes with Capacities of Twice the Theoretical Value; Small, 18, 2203918 (2022)
- [31] T. Chen, H. Kaur, M. McCrystall, R. Tian, A. Roy, R. Smith, D. Horváth, J. Maughan, B. Konkena, M. Venkatesan, K. Synnatschke, T. Carey, J. Lui, J. Pepper, R. Zhang, C., V. Nicolosi, H. Xia and J. Coleman; Liquid Phase Exfoliation of Nonlayered Non-Van Der Waals Iron Trifluoride (FeF<sub>3</sub>) into 2D-Platelets for High-Capacity Lithium Storing Cathodes; FlatChem, 33, 100360 (2022)
- [30] A. Garcia-Gil, S. Biswas, A. Roy, D. Saladukh, S. Raha, T. Blon, M. Conroy, V. Nicolosi, A. Singha, L. M. Lacroix and J. D. Holmes; Growth and analysis of the tetragonal (ST12) germanium nanowires; Nanoscale, 14, 2030-2040 (2022)
- [29] A. Garcia, S. Biswas, D. McNulty, A. Roy, S. Raha, S. Trabesinger, V. Nicolosi, A. Singha and J. D. Holmes; One-step Grown Carbonaceous Germanium Nanowires and their Application as Highly-efficient Lithium-ion Battery Anodes; ACS Applied Energy Materials, 5, 1922-1932 (2022)
- [28] E. Piatti, A. Arbab, F. Galanti, T. Carey, L. Anzi, D. Spurling, A. Roy, A. Zhussup-bekova, K. A. Patel, J. M. Kim, D. Daghero, R. Sordan, V. Nicolosi, R. S. Gonnelli, F. Torrisi; Charge transport mechanisms in inkjet-printed thin-film transistors based on two-dimensional materials; Nature Electronics, 4, 893-905 (2021)
- [27] D. Samantaray, M. Gayen, A. Roy, B. Pavithra, N. Ravishankar; Mechanistic understanding of formation of ultrathin single crystalline Pt nanowires; Journal of Physical Chemistry C, 125, 27458-27464 (2021)
- [26] H. Kaur, R. Tian, A. Roy, M. McCrystall, R.Smith, V. Nicolosi, J. Coleman; 2D Nanosheets from Fool's gold by LPE: High performance lithium-ion battery anodes made from stone; FlatChem, 30, 102995 (2021)
- [25] D. Tyndall , S. Jaskaniec, B. Shortall, A. Roy, L. Gannon, K. O'Neill, M. P. Browne, J. Coelho, C. McGuinness, G. S. Duesberg and V. Nicolosi; Post-Synthetic Treatment of Nickel-Iron Layered Double Hydroxides for Optimum Catalysis of the Oxygen Evolution Reaction; npj 2D Materials and Applications, 5, Article number: 73 (2021)
- [24] P. Thakur, K. Alam, A. Roy, C. Downing, V. Nicolosi, P. Sen, T. N. Narayanan; Extending the Cyclability of Alkaline Zinc-Air Batteries: Synergistic Roles of Li<sup>+</sup> and K<sup>+</sup> Ions in Electrodics; ACS Applied Materials & Interfaces, 13, 33112–33122 (2021)
- [23] S. Ippolito, A. G. Kelly, R. F. de Oliveira, M. A. Stoeckel, D. Iglesias, A. Roy,
   C. Downing, Z. Bian, L. Lombardi, Y. A. Samad, V. Nicolosi, A. C. Ferrari, J.
   N. Coleman, P. Samori; Covalently interconnected transition metal dichalcogenide

- networks via defect engineering for high-performance electronic devices; Nature Nanotechnology, 16, 592–598 (2021)
- [22] H. Kaur, R. Tian, A. Roy, M. McCrystall, D. Horváth, M. Ruether, A. Griffin, C. Backes, V. Nicolosi, J. Coleman; Production of quasi-2D platelets of non-layered iron pyrite (FeS<sub>2</sub>) by liquid-phase exfoliation and their use in high performance battery anodes; ACS Nano, 14, 13418-13432 (2020)
- [21] G. Prakash, S. Kundu, A. Roy, A. K. Singh, N. Ravishankar and A. K. Sood; Carrier Dynamics in Ultrathin Gold Nanowires: Role of Auger Processes; Plasmonics, 15, 1151–1158 (2020)
- [20] T. Ahmed, P. Bellare, R. Debnath, A. Roy, N Ravishankar and A. Ghosh; Thermal history dependent current relaxation in hBN/MoS $_2$  van der Waals dimers; ACS Nano, 14, 5909-5916 (2020)
- [19] P. Kumar, K. Thakar, N. Verma, J. Biswas, T. Maeda, A. Roy, K. Kaneko, C. Nandi, S. Lodha, B. Viswanath; Polymorphic in-plane heterostructure of WS<sub>2</sub> for light-triggered FET device applications; ACS Applied Nano Materials, 3, 3750-3759 (2020)
- [18] L. Sharma, R. Gond, B. Senthilkumar, A. Roy, P. Barpanda; Fluorophosphates as Efficient Bifunctional Electrocatalysts for Metal-air Batteries; ACS Catalysis, 10, 43-50 (2020)
- [17] N. Jain, A. Roy; Phase & Morphology Engineered Surface Reducibility of MnO<sub>2</sub> Nano-heterostructures: Implications on Catalytic Activity towards CO Oxidation; Materials Research Bulletin, 121, 110615 (2020)
- [16] N. Jain, A. Roy, A. De; Ba-addition Induced Enhanced Surface Reducibility of SrTiO<sub>3</sub>: Implication on Catalytic Aspects; Nanoscale Advances, 1, 4938-4946 (2019)
- [15] N. Jain, A. Roy, S. Nair; Reduced SrTiO<sub>3</sub>-Supported PtCu Alloy Nanoparticles for Preferential Oxidation of CO in Excess Hydrogen; Nanoscale, 11, 22423-22431 (2019)
- [14] R. K. Rai, S. Islam, A. Roy, G. Agrawal, A. K. Singh, A.Ghosh and N Ravishankar; Morphology Controlled Synthesis of Low Bandgap SnSe<sub>2</sub> with High Photodetectivity; Nanoscale, 11, 870-877 (2019)
- [13] P. Kumar, D. Chatterjee, T. Maeda, A. Roy, K. Kaneko and B. Viswanath; Scalable faceted voids with luminescence enhanced edges in WS<sub>2</sub> monolayers; Nanoscale, 10, 16321-16331 (2018)
- [12] S. Tripathi, A. Roy, S. Nair, S. Durani, and R. Bose; Removal of U(VI) from aqueous solution by adsorption onto synthesized silica and zinc silicate nanotubes: Equilibrium and kinetic aspects with application to real samples; Environmental Nanotechnology, Monitoring & Management, 10, 127-139 (2018)

- [11] K. Ghosh,<sup>‡</sup> A. Roy,<sup>‡</sup> S. Tripathi, S. Ghule, A. K. Singh and N. Ravishankar; Insights on Nucleation and Growth of Different Phases of WO<sub>3</sub>: Morphology Control and Electrochromic Property; Journal of Materials Chemistry C, 5, 7307-7316 (2017)
- [10] A. Pradhan, A. Roy, S. Tripathi, A. Som, D. Sarkar, J. K. Mishra, K. Roy, T. Pradeep, N, Ravishankar and A. Ghosh; Ultra-high Sensivity Infra-red Detection and Temperature Effects in Graphene-Tellurium Nanowire Binary Hybrid; Nanoscale, 9, 9284-9290 (2017)
- [9] A. Manjanath, <sup>‡</sup> A. Roy, <sup>‡</sup> A. Samanta and A. K. Singh; Negative Differential Resistance in Armchair Silicene Nanoribbons; IOP Nanotechnology, 28, 275402 (2017)
- [8] T. Maeda, K. Kaneko, K. Yamada, A. Roy, Y. Sato, R. Teranishi, T. Kato, T. Izumi, and Y. Shiohara; Nanostructural characterization of artificial pinning centers in PLD-processed REBa $_2$ Cu $_3$ O $_{7-\delta}$  films; Ultramicroscopy, 176, 151-160 (2017)
- [7] A. Roy,<sup>‡</sup> K. R. Amin,<sup>‡</sup> S. Tripathi, S. Biswas, A. K. Singh, A. Bid, and N. Ravishankar; Manipulation of Optoelectronic Properties and Band Structure Engineering of Ultrathin Te Nanowires by Chemical Adsorption; ACS Applied Materials and Interfaces, 9, 19462-19469 (2017)
- [6] K. R. Amin, S. Kundu, S. Biswas, A. Roy, A. K. Singh, and N. Ravishankar; Effect of Ambient on Electrical Transport Properties of Ultrathin Au Nanowires; Applied Physics Letters, 109, 253108 (2016)
- [5] A. Roy, S. Tripathi, Y. Sato, and K. Kaneko; Transmission Electron Microscopic Analysis of One-dimensional Metal Nanowire: The Case of Tellurium and Gold; Materia Japan, 55 (12), 603 (2016)
- [4] S. Tripathi, A. Roy, R. Bose, S. Nair, and N. Ravishankar; Synthesis of Hollow Nanotubes of Zn<sub>2</sub>SiO<sub>4</sub> or SiO<sub>2</sub>: Mechanistic Understanding and Uranium Adsorption Behaviour; ACS Applied Materials and Interfaces, 7 (48), 26430–26436 (2015)
- [3] A. Roy, S. Kundu, K. Müller, A. Rosenauer, S. Singh, P. Pant, M. P. Gururajan, P. Kumar, J. Weissmüller, A. K. Singh, and N. Ravishankar; Wrinkling of Atomic Planes in Ultrathin Gold Nanowires; Nano Letters, 14, 4859-4866 (2014)
- [2] A. Roy, T. Pandey, N. Ravishankar, and A. K. Singh; Semiconductor-like Sensitivity in Metallic Ultrathin Gold Nanowire based Sensors; Journal of Physical Chemistry C, 118, 676- 682 (2014)
- [1] A. Roy, T. Pandey, N. Ravishankar, and A. K. Singh; Single Crystalline Ultrathin Gold Nanowires: Promising Nanoscale Interconnects; AIP Advances 3, 032131 (2013)
  - † denotes equal contribution
  - \* denotes corresponding author

# Conference Proceedings

- 2022 L. Hughes, A. Roy, C. Downing, M. P. Browne, A. Zhussupbekova, V. Nicolosi; The Advanced Characterization and Structure-Property Correlation of BaMnO<sub>3</sub> for the Oxygen Reduction Reaction Using Electron Microscopy; Microscopy and Microanalysis 28 (S1), 2586-2588
- 2022 T. Simonian, A. Roy, Z. Sofer, V.Nicolosi; Characterisation of Planar Defects in Ternary Layered Chalcogenides for Electronic Devices; Microscopy and Microanalysis 28 (S1), 2392-2393
- 2021 T. Simonian, A. Roy, V.Nicolosi, Z. Sofer; Characterisation and Defect Analysis of 2D Layered Ternary Chalcogenides; Microscopy and Microanalysis 27 (S1), 642-643
- 2020 D. Samantaray, S. Shetty, S. Mondal, A. Roy, D. Chatterjee, P. Bellare, N Ravishankar; Mechanistic Studies of Growth of Ultrathin Pt and Alloy Nanowires; Microscopy and Microanalysis 26 (S2), 2400-2401
- 2020 R. K. Rai, S. Islam, A. Roy, G. Agrawal, A. Ghosh, N Ravishankar; Morphology Controlled Low-dimensional Single-crystalline SnSe<sub>2</sub>-Graphene Hybrid for near IR Photodetection; Microscopy and Microanalysis 26 (S2), 2338-2340
- 2018 A. Pradhan, A. Roy, S. Tripathi, D. Sarkar, J. K. Mishra, K. Roy, T. Pradeep, N Ravishankar, A. Ghosh; Temperature Dependent Infra-red Detection in Graphene-Tellurium Nanowire Binary Hybrid with Ultra-high Sensitivity; APS March Meeting 2018, abstract id.T60.175
- 2017 S. Tripathi, K. Ghosh, A. Roy, A. K. Singh, N Ravishankar; Wet-chemical Synthesis of Electrochromic WO<sub>3</sub> and  $W_xMo_{1-x}O_3$  Nanomaterials with Phase and Morphology Control; Microscopy and Microanalysis 23 (S1), 1876-1877
- 2017 S. Tripathi, A. Roy, N Ravishankar; Ambient Dependent Formation of Zn<sub>2</sub>SiO<sub>4</sub> and SiO<sub>2</sub> from Core-shell ZnO@SiO<sub>2</sub>; Microscopy and Microanalysis 23 (S1), 1758-1759
- 2017 S. Tripathi, K. Ghosh, A. Roy, A. K. Singh, N Ravishankar; Electrochromic tungsten molybdenum oxide: synthesis with phase and morphology control; Acta Crystallographica A- Foundation and Advances 73, C1223
- 2016 A. Roy, K. Müller, K. Kaneko, A. Rosenauer, J. Weismüller, A. K. Singh, N Ravishankar; Atomic relaxation in ultrathin FCC metal nanowires; European Microscopy Congress 2016: Proceedings, 423-424

# Outreach Experience

2017 Microscopy at the Ultimate Limit: 'See'-ing the Atoms in Materials, Invited talk at Meizen High School, Kurume, Fukuoka, Japan (JSPS Science Dialogue Program)

#### **Invited Talks**

Aug 2021 Synergistic Atomic-scale Electron Microscopy and Atomistic Simulations for Metal Nanowires; Future of Chemistry Symposium, Tata Institute of Fundamental Research, Mumbai, India

- Jun 2019 Combinatorial Interrogation of Functional Nanomaterials through Electron Microscopy and DFT Simulations; EMAAT International Conference, Shimla, Himachal Pradesh, India
- Oct 2018 Synergistic Atomistic Simulations and Designed Experiments for Functional Nanomaterials; IIT Mandi, Himachal Pradesh, India.
- Aug 2018 Functional Materials Approaching Molecular Scale: Insights from Electron Microscopy, Simulations & Designed Experiments; TIFR-TCIS Hyderabad, India
- July 2017 Functional Low dimensional Materials: Insights from Atomistic Simulations and Designed Experiments; Department of Metallurgical and Materials Engineering, IIT Madras, India
- July 2017 Functional Low dimensional Materials: from Ab Initio Simulations and Experiments; CGCRI, Kolkata, India
- July 2017 Designed Experiments on Functional Low dimensional Materials from Ab Initio Simulations; S. N. Bose National Centre for Basic Sciences, Kolkata, India
- July 2017 Functional Low dimensional Materials from Atomistic Simulations and Targeted Experiments; Department of Chemistry, IIT Guwahati, India

# Contributed Talks

- 2020 Phase and Morphology Dependent Ion-intercalation in Electrochromic WO<sub>3</sub>; Microscopy Society of Ireland Symposium, Trinity College Dublin, Ireland
- 2018 3-D Atomic Structure of Ultrathin Metal Nanowires: the Cases of Au and Pt; Annual Meeting of Electron Microscope Society of India, Bhubaneswar, India
- 2017 Adsorption Induced Band Structure Engineering of Te Nanowires; Annual Meeting of Electron Microscope Society of India, Mahabalipuram, India
- 2016 NO<sub>2</sub> Adsorption Induced Semiconductor to Metal Transition in Ultrathin Te Nanowires; ICTAM-AMF-10, Delhi, India
- 2016 Atomic Relaxation in Ultrathin FCC metal Nanowires; European Microscopy Congress, Lyon, France
- 2015 Intriguing Atomic Structure and Semiconductor Nanowire Equivalent Sensitivity of Ultrathin Gold Nanowires; Japan Society of Microscopy Regional Meeting, Kyushu University, Japan
- 2014 Semiconductor-like Sensitivity Using Ultrathin Au Nanowire Sensors; Materials Research Society, Fall- 2014, Boston, Massachusetts, USA

#### Professional Membership

Life member Electron Microscope Society of India (EMSI)

# Community Service

Reviewer J. Mat. Sci., ACS Sustain. Chem. Eng., npj 2D Mater. Appl.

# Languages

Bengali Mothertongue

English **Expert** 

Hindi **Intermediate** 

Proficient in reading, writing and speaking

Conversationally fluent