

Education

- 2018–2021 **M.S.**, Materials Science & Engineering, *Cornell University, USA*, 3.85/4
- Distinction, thesis, 1 peer-reviewed journal publication, 4 patents, 1 yr co-op at Applied Materials Inc.
- 2010–2015 **B.E.**, Chemical Engineering & **M.Sc.**, Chemistry (**Dual degree**), *BITS Pilani, India*, 7.45/10
- 1 among 2000 admitted from 300000 BITSAT test-takers, BITS MCN scholarship (6x semesters)

Master thesis

- Title Development of multiscale hierarchical structures from nanocluster mesophases
- Advisors Prof. Richard Robinson (primary advisor) | Prof. Tobias Hanrath (co-advisor), *Cornell University*
- Summary This thesis focuses on the scalable synthesis and hierarchical self-assembly of ultra-small atomically precise magic-sized nanocrystals (MSNC) (<1.2 nm, 6% disperse) into chiroptical thin-films (2 cm x 2 cm, g-factor ~1.30). We achieved this through a multi-step approach of i) restricting crystal nuclei growth in II-VI semiconductors by concentration-saturation based size-focusing, ii) One-pot gram-scale synthesis and thin-film self-assembly, iii) analytical and chiroptical characterization
- Key findings i) Chirality-induced spin selectivity (CISS) in quantum-dot thin films for chiral spin-filters, ii) path for tunable achiral to chiral material conversion, iii) controlled inorganic MSNC isomerization
- Publications H. X. Han, **S. Kallakuri** et al. Multiscale hierarchical structures from a nanocluster mesophase. *Nature Materials*, 21(5): 518-525 (2022)

Research and Development Experience

- 2021–Now **Senior Process Engineer (prior co-op intern)**, *Applied Materials Inc. (AMAT)*, Santa Clara
- Sept–Now ALD & Epitaxy Unit (co-op intern at Varian ion-implant unit, 2019-2020), Semiconductor Products
- Solved critical leading node customer issues on crystalline interfaces, electrical properties, conformality
 - Developed low-k dielectric deposition PEALD processes for sub-1.4nm multigate (GAAFET) transistors
 - Invented grayscale RIE etch for photonic blazed/holographic diffraction gratings at CTO AR/VR unit
 - Co-invented 6 patents, received 2 excellence awards for enabling new technology as employee and intern
- 2017 **Visiting Researcher**, *Massachusetts Institute of Technology (MIT)*, Cambridge
- Mar–Jun Prof. Julia Ortony Lab, Department of Materials Science and Engineering
- Conducted foundational research to synthesize/characterize self-assembling aramid amphiphile precursors
 - Characterized spin dynamics of TEMPO-bound self-assemblies via pulsed-EPR and SAXS (Argonne lab)
- 2016–2017 **Graduate Research Assistant**, *Harvard Medical School (HMS)*, Boston
- Aug–Feb Prof. Hadi Shafiee Lab, Division of Engineering for Medicine
- Fabricated electrochemical microchips integrating Pt-Au nanomotor biosensors via thio-azide crosslinking
 - Detected HIV/Zika by particle velocimetry biosensing ($\eta=97\%$); published in *Nature Comm.*, *ACS Nano*
- 2015 **Undergraduate Research Assistant**, *Indian Institute of Chemical Technology (IICT)*, Hyderabad
- Jan–Jul Prof. Gokulnath Sabapathi Lab, Inorganic and Physical Chemistry Division
- Designed and synthesized a Porphyrin-Dithienopyrrole photo-sensitizer for dye-sensitized solar cells
 - Quantified the dye's impedance spectra, bound it to Titania scaffolds and built a DSSC prototype

Selected Publications and Conferences

- 2022 H. X. Han, **S. Kallakuri**, Y. Yao, C. B. Williamson, D. R. Nevers, B. H. Savitzky, R. S. Skye, M. Xu, O. Voznyy, J. Dshemuchadse, L. F. Kourkoutis, S. J. Weinstein, T. Hanrath, R. D. Robinson. Multiscale hierarchical structures from a nanocluster mesophase. *Nature Mat.*, 21(5): 518-525
- 2022 **S. Kallakuri**, Z. Zhang, R. Patil, L. Sun, M. Copic. A CNN-powered AI-driven approach to semiconductor defect classification. *AIx conference, Applied Materials*
- 2018 M. S. Draz, K. M. Kochehbyoki, A. Vasana, D. Battalapalli, A. Sreeram, M. K. Kanakasabapathy, **S. Kallakuri**, A. Tsibris, D. R. Kuritzkes, H. Shafiee. DNA-engineered micromotors powered by metal nanoparticles for motion-based cellphone diagnostics. *Nature Comm.*, 9(1): 4282
- 2018 M. S. Draz, N. K. Lakshminaraasimulu, S. Krishnakumar, D. Battalapalli, A. Vasana, M. K. Kanakasabapathy, A. Sreeram, **S. Kallakuri**, P. Thirumalaraju, Y. Li, S. Hua, X. G. Yu, D. R. Kuritzkes, H. Shafiee. Motion-based immunological detection of Zika virus using Pt-nanomotors and a cellphone. *ACS Nano*, 12(6): 5709-5718

Experimental skills

Cleanroom	PEALD/ALE, PECVD, RIE, atomic-layer epitaxy, directional deposition, μ -wave & RF hardware
Analysis	NMR, EPR, XRD, IV/CV, TR-PL, UVabs, OES, XPS, FTIR, SAXS (Argonne), ellipsometry
Hardware	UHV Microwave & RF plasma hardware, conical impedance transformer, vector network analyzer
Photonics	Diffraction gratings and waveguide etch & deposition, chiroptical materials, polarized microscopy
Patterning	Grayscale lithography, angular ion etch, passivation, moire masking, directed self-assembly
Synthesis	Nanoparticles, quantum-dots, photosensitizers, conductive polymers, zwitterion amphiphiles

Patents

- 2024 Techniques based on directional seeding and selective deposition (Part-1: US11956978B2)
- 2024 Techniques based on directional seeding and selective deposition (Part-2: US20240040808A1)
- 2023 Techniques for void-free material depositions (Part-1: US11749564B2)
- 2023 Techniques for void-free material depositions (Part-2: US12131948B2)
- 2022 Metal line patterning (US11404314B2)
- 2022 Devices and methods for variable etch depths (US20220100078A1)
- 2022 Techniques for variable deposition profiles (US20220119955A1)

Software skills

Programming	Python, Java, C, Javascript, HTML	Visualization	Matplotlib, Tableau, Seaborn, PyQT
Data analysis	Pandas, NumPy, SciPy, SAS(JMP)	Simulation	COMSOL, LAMMPS MD, GAMESS
Modeling	AutoCAD, Blender, Solidworks	Other	MatLab, Mathematica, Origin, SQL

Teaching

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| 2021 | TA, MSE5860 (Atomic Structure) | 2018 | TA, MSE4330 (Energy Materials) |
| 2019 | TA, ENGRG1060 (Intro to Engineering) | 2019 | Mentor, Expanding your horizons (EYH) |

Awards and Honors

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| 2025 | Make Possible award, AMAT | 2015 | MCN scholarship (6x), BITS Pilani |
| 2020 | Intern Excellence award, AMAT | 2014 | E&M UG scholarship, TIME Institute |
| 2014 | National Medalist in Carom, 3 Gold, 1 Silver at BOSM, SPREE, AICF meets | | |

Outreach

- 2018–2021 Organizer, SPICMACAY Cornell, 8 classical music concerts
- 2018–2019 Team Lead, Asha for Education, Raised \$18,000 for rural schools
- 2015–2016 Volunteer, Nirmaan, Public health awareness campaigns
- 2014–2016 Organizer, Yuva, Science education and awareness camps in rural India