Dr. Safiul Alam Mollick

Assistant Professor
Department of Physics, Rabindra Mahavidyalaya
Champadanga, Hooghly, West Bengal, India

ResearchGate Profile

EDUCATION

- **Ph.D. in Physics**
  Institution: University of Calcutta / Saha Institute of Nuclear Physics
  Thesis Title: *"Ion-Induced Pattern Formation on Solid Surfaces"*
  Timeline: Submitted August 2014; Awarded April 22, 2016
- **National Eligibility Test (NET)**
  Qualified: 2006

ACADEMIC & ADMINISTRATIVE EXPERIENCE

- **Assistant Professor**, Department of Physics, Rabindra Mahavidyalaya (18 December 2019 – Present)
- **Convener**, Academic and Routine Sub-committee
- **Joint Convener**, IT Sub-committee
- **Member**, PF Sub-committee
- **Member**, Career Advancement Cell Sub-committee

TEACHING PORTFOLIO

Delivering core undergraduate Physics curricula across multiple specialized modules:

- **Theoretical Foundations:** Quantum Mechanics, Mathematical Physics, Thermal Physics
- **Dynamics & Waves:** Mechanics, Waves and Oscillations
- **Modern Frontiers:** Elements of Modern Physics, Astronomy and Astrophysics

CORE RESEARCH INTERESTS

- **Advanced Semiconductor Etching & Surface Functionalization:** Metal-Assisted Chemical Etching (MaCE) optimization parameters (e.g., elevated temperature tracking at $75 \pm 2^{\circ}$C); pyramidal texturing techniques for light-trapping architectures; Cold Cathode Electron Emission optimization.
- **Ion-Beam Induced Surface Instabilities & Nanopatterning:** Threshold-energy nanorippling driven by Ehrlich-Schwoebel (ES) barriers under ultra-low energy (30 eV) Ar^{+} ion bombardment; symmetry-driven self-organization (GaAs and Ge surfaces); substrate dynamic thermal recrystallization dynamics.
- **Mathematical & Continuum Modeling:** Solving non-linear partial differential equations integrating Kardar-Parisi-Zhang (KPZ) scaling and Herring-Mullins diffusion currents to model Atomic Force Microscopy (AFM) and Transmission Electron Microscopy (TEM) surface morphology data.

REPRESENTATIVE PUBLICATIONS

1. S. Mollick, et al. **"Understanding temporal evolution of microstructures on metal-assisted chemically etched Ge surface and its applications."** *Solar Energy*, 221, 185-196 (2021).

2. S. Mollick, et al. **"Nanorippling of ion irradiated GaAs (001) surface near the sputter-threshold energy."** *Physica Status Solidi B*, 252(4), 811-815 (2015).

3. S. Mollick, et al. **"Homoepitaxy of germanium by hyperthermal ion irradiation."** *Vacuum*, 107, 23-27 (2014).

JOURNAL PUBLICATIONS

1. J. Mukherjee, **S. A. Mollick**, T. Basu, and T. Som.
"Performance optimization of a microwave-coupled plasma-based ultralow-energy ECR ion source for silicon nanostructuring."
Beilstein Journal of Nanotechnology, vol. 16, pp. 484–494, 2025.

2. Sudheer, R. Mandal, D. Hasina, **S. Alam Mollick**, A. Mandal, M. Ranjan, and T. Som.
"Low-Energy Ion-Implanted Nanometer-Thick Metal Oxide Memristor for Random Number Generation at the Nanoscale."
ACS Applied Nano Materials, vol. 8, no. 13, pp. 6327–6335, 2025.

3. R. Mandal, D. Hasina, A. Dutta, **S. A. Mollick**, A. Mandal, and T. Som.
"Linearly potentiated synaptic weight modulation at nanoscale in a highly stable two-terminal memristor."
Applied Surface Science, vol. 610, p. 155411, 2023.

4. **S. A. Mollick**.
"Effect of impurities on the nanostructure formation on Ge(100) substrate by 26 keV ion implantation."
International Journal of Innovative Research in Technology, vol. 10, no. 3, pp. 653–658, 2023.

5. A. Dutta, **S. A. Mollick**, P. Maiti, and T. Som.
"Understanding temporal evolution of microstructures on metal-assisted chemically etched Ge surface and its applications."
Solar Energy, vol. 221, pp. 185–196, 2021.

6. D. Hasina, M. Kumar, R. Singh, **S. A. Mollick**, A. Mitra, S. K. Srivastava, M. A. Luong, and T. Som.
"Ion beam-mediated defect engineering in TiO_x thin films for controlled resistive switching property and application."
ACS Applied Electronic Materials, vol. 3, no. 9, pp. 3804–3814, 2021.

7. T. Chabri, A. Barman, S. Chatterjee, **S. A. Mollick**, and T. K. Nath.
"Effects of transitional hysteresis on the large magnetocaloric and magnetoresistance properties of Ni-Mn-Co-Sn Heusler alloy."
Journal of Alloys and Compounds, vol. 863, p. 158485, 2021.

8. **S. A. Mollick**, R. Singh, B. Satpati, S. Bhattacharyya, and T. Som.
"Growth angle-dependent evolution of morphology and magnetic properties of Co films on highly ordered self-organized Ge substrates."
Journal of Magnetism and Magnetic Materials, vol. 498, p. 166198, 2020.

9. R. Singh, **S. A. Mollick**, M. Saini, P. Guha, and T. Som.
"Experimental and simulation studies on temporal evolution of chemically etched Si surface: Tunable light trapping and cold cathode electron emission properties."
Journal of Applied Physics, vol. 125, no. 16, p. 165302, 2019.

10. **S. A. Mollick**, R. Singh, M. Kumar, S. Bhattacharyya, and T. Som.
"Strong uniaxial magnetic anisotropy in Co films on highly ordered grating-like nanopatterned Ge surfaces."
Nanotechnology, vol. 29, no. 12, p. 125302, 2018.

11. **S. A. Mollick**, M. Kumar, R. Singh, B. Satpati, D. Ghose, and T. Som.
"Gold-decorated highly ordered self-organized grating-like nanostructures on Ge surface: Kelvin probe force microscopy and conductive atomic force microscopy studies."
Nanotechnology, vol. 27, no. 43, p. 435302, 2016.

12. D. Chowdhury, D. Ghose, **S. A. Mollick**, B. Satpati, and S. R. Bhattacharyya.
"Nanorippling of ion irradiated GaAs (001) surface near the sputter-threshold energy."
Physica Status Solidi B, vol. 252, no. 4, pp. 811–815, 2015.

13. **S. A. Mollick**, D. Ghose, P. D. Shipman, and R. M. Bradley.
"Anomalous patterns and nearly defect-free ripples produced by bombarding silicon and germanium with a beam of gold ions."
Applied Physics Letters, vol. 104, no. 4, p. 043103, 2014.

14. **S. A. Mollick**, D. Ghose, S. R. Bhattacharyya, S. Bhunia, N. R. Ray, and M. Ranjan.
"Synthesis of SiGe layered structure in single crystalline Ge substrate by low energy Si^- ion implantation."
Vacuum, vol. 101, pp. 387–393, 2014.

15. D. Chowdhury, D. Ghose, and **S. A. Mollick**.
"Homoepitaxy of germanium by hyperthermal ion irradiation."
Vacuum, vol. 107, pp. 23–27, 2014.

16. **S. A. Mollick**, D. Ghose, and B. Satpati.
"Formation of Au–Ge nanodots by Au^- ion sputtering of Ge."
Vacuum, vol. 99, pp. 289–293, 2014.

17. **S. A. Mollick**, B. Satpati, and D. Ghose.
"Evolution of ripples on GaAs (001) surface under low energy Ar^+ ion bombardment."
Nuclear Instruments and Methods in Physics Research Section B, vol. 315, pp. 43–47, 2013.

18. A. Metya, D. Ghose, **S. A. Mollick**, and A. Majumdar.
"Nanopatterning of mica surface under low energy ion beam sputtering."
Journal of Applied Physics, vol. 111, no. 7, p. 074313, 2012.

19. **S. A. Mollick**, S. Karmakar, A. Metya, and D. Ghose.
"Pit formation on the Ge (1 0 0) surfaces by normal incident Si^- ion implantation."
Applied Surface Science, vol. 258, no. 9, pp. 4129–4134, 2012.

20. **S. A. Mollick** and D. Ghose.
"Formation and characterization of perpendicular mode Si ripples by glancing angle O_2^+ sputtering at room temperature."
Journal of Applied Physics, vol. 106, no. 4, p. 044309, 2009.

21. P. Karmakar, **S. A. Mollick**, D. Ghose, and A. Chakrabarti.
"Role of initial surface roughness on ion induced surface morphology."
Applied Physics Letters, vol. 93, no. 10, p. 103106, 2008.

CONFERENCE PROCEEDINGS & PREPRINTS

1. **S. A. Mollick**, S. R. Bhattacharyya, and D. Ghose.
"Field emission from metal-assisted chemically etched Germanium microstructures."
AIP Conference Proceedings, vol. 2265, no. 1, p. 030198, 2020.

2. **S. A. Mollick** and D. Ghose.
"The study of the mechanical properties of Au films by nanoindentation techniques."
AIP Conference Proceedings, vol. 1447, no. 1, pp. 643–644, 2012.

3. **S. A. Mollick** and D. Ghose.
"Formation of ripple pattern on silicon surface by grazing incidence ion beam sputtering."
arXiv preprint arXiv:0904.1311, 2009.

EXPERIMENTAL VS. NUMERICAL SURFACE SCALING

Processing Domain	**Experimental Tools**	**Continuum Model Terms Applied**	**Selected System Metrics**
Chemical Etching (MaCE)	AFM, FESEM, UV-vis-NIR Spectrophotometry	$\frac{\partial h}{\partial t} = -\epsilon\nabla\vec{J_F} + \sigma(\nabla h)^2 + K\nabla^4 h + \eta$	Average reflectivity $< 0.23\%$; turn-on fields ~ 1.7 V μm^{-1}
Ion Bombardment (Ar^+)	AFM Tapping, XTEM (Cross-Sectional TEM)	$\sum[-\epsilon_i\partial_i(\partial_i h(1 - \delta(\partial_i h)^2))] - \sum[K_{ij}\partial_i^2\partial_j^2 h + \sigma_{ij}\partial_i^2(\partial_j h)^2]$	Crystalline nanowires (GaAs) and checkerboard arrays (Ge)