Santanu Talukder

Ph.D. Research Scholar,
Centre for Nano Science and Engineering,
Indian Institute of Science, Bangalore - 560012
Mobile: (+91) 9632716218 **Email Id:** santanu.809@gmail.com

Research interest

- Electromigration in metallic thin films and their applications in fabrication and sensing technologies.
- Micro/ nano fabrication and characterization
- Nano scale devices and sensor.

Education

- **Ph.D.** – Final year Ph.D. student working under supervision of Professors Rudra Pratap (Center of Nanoscience and Engineering, Mechanical Engineering) and Praveen Kumar (Materials Engineering) in IISc, Bangalore. Thesis, titled "Study and control of electromigration driven material transport for applications in nanofabrication and patterning" is expected to be submitted by June, 2015. (A short synopsis of thesis is outlined in the last page of this CV)
- **Bachelors of Technology** - Electronics & Instrumentation, Jadavpur University, Kolkata, 2010
- **Bachelors of Science** – Physics, Jadavpur University, Kolkata, 2007

Awards and achievements

- Ministry of Human Resource and Development, Government of India - Research Fellow Scholarship for Pursuing PhD at IISc.
- All India rank 17 in GATE 2010 (in Instrumentation paper)
- All India rank 55 in IIT JAM 2007 in Physics paper (Joint Admission Test to M.Sc. at IITs)
- All India rank 14 in JEST 2007 in Physics Paper (Joint Entrance Screening Test for Admission to PHD at various research institutes).
- National Merit Scholarship on the basis of 12^{th} standard board examination Result.
- National Merit Scholarship on the basis of 10^{th} standard board examination Result.

Technical Skills

- Expert user of the following fabrication techniques/tools:
  Wet Chemical Etching; Photolithography with Laser Writer and Mask Aligner; Electron Beam Lithography; RF and DC Magnetron Sputtering; Lift off technique for patterning
- Expert user of the following Characterization techniques/tools:
  IV-CV characterization with Agilent Device Analyzer (B1500); UHV system with low temperature probe station for electrical characterization; Micro System Analyzer; Optical Profiler; Atomic Force Microscopy and Scanning Tunneling Microscopy; Scanning Probe Microscopy; Scanning Electron Microscopy with EDS technique; Focused Ion Beam; X-ray Photoelectron Spectroscopy

Software and Programming Skills

1. MATLAB (with SIMULINK), LABVIEW, COMSOL and ANSYS
2. C/C++, VHDL and Microcontroller programming

Extra-curricular activities

- Treasurer of the "IEEE-IISc Nanotechnology Council and Sensor Council Joint Student Chapter" for the year 2013-2014.
- On behalf of the IEEE-IISc NC and SC Joint Student Chapter, successfully organized 1st National Workshop on Nanotechnology and Sensors in September 2013.
- Coordinator of departmental seminar committee since 2011, as part of this successfully arranged over 50 talks/seminars till now.

Patent

- A device, system and method generating structures on a substrate by electromigration, S. Talukder, P. Kumar, and R. Pratap, Indian patent application IPA12130001 (9 December 2014).

Publications

Journals

1. "Electrolithography"- A Novel Patterning Technique Using Electric Field Driven Material Transport, Santanu Talukder, Praveen Kumar and Rudra Pratap (To be communicated).
2. Creating wavy surfaces on a metallic path using electric field driven mass transport, Santanu Talukder, Praveen Kumar and Rudra Pratap (To be communicated).
3. Controlled Material Transport and Multidimensional Patterning at Small Length Scales using Electromigration, Santanu Talukder, Praveen Kumar and Rudra Pratap (Accepted in **Current Science**).

4. Film thickness mediated transition in the kinetics of electric current induced flow of thin liquid metal films, Santanu Talukder, Praveen Kumar and Rudra Pratap **Appl. Phys. Lett.**, vol. 104, pp. 214102_1-214102_4, 2014.
5. Electric current induced mass flow in very thin infinite metallic films, Santanu Talukder, Praveen Kumar and Rudra Pratap, **IEEE Trans. Elec. Dev**., vol. 60, pp. 2877-2883, 2013.
6. Effect of substrate surface roughness on electric current induced flow of liquid metals, Santanu Talukder, Nalla Somaiah and Praveen Kumar, **Appl. Phys. Lett.** 102, 054101 (Jan, 2013)
7. Nanoscale Control of Electro-migration for Resistance Tuning of Metal Lines, SantanuTalukder, ArindamGhosh and RudraPratap, **Journal of ISSS**, Vol. 1 No. 1, pp. 16-22, (Sept 2012)

Conferences

1. "Material Transport and 3-D Patterning at Small Length Scales using Controlled Electromigration", Santanu Talukder, Praveen Kumar and Rudra Pratap, 2nd IEEE International Conference on Emerging Electronics, Bangalore, December 2014.
2. "Tailoring electromigration in liquid and solid states for fabricating highly reliable piezoresistive sensors", Santanu Talukder, Praveen Kumar and Rudra Pratap, International Conference on MEMS and Sensor, Chennai, December 2014.
3. "Nanoscale control of Electromigration for enhancing metal piezoresistivity", SantanuTalukder, ArindamGhosh and RudraPratap; paper presented at International Conference on Smart Materials Structures and Systems January 04-07, 2012, Bangalore, India
4. "Creation by destruction with an Electron Tsunami", Santanu Talukder, Praveen Kumar, Arindam Ghosh and Rudra Pratap; poster presented at 'Bangalore- Nano 2012' international conference [8th Dec, 2011].
5. "Relay Feedback Based Improved Critical Point Estimation for Process Control Systems", D. Simhachalam, S. Talukder and R. K. Mudi; Communications in Computer and Information Science, 1, Volume 250, Computational Intelligence and Information Technology, Part 1, Pages 60-64

References

Dr. Rudra Pratap,
Chairman and Professor,
Centre for Nano Science and Engineering,
Indian Institute of Science,
Bangalore - 560012
E-mail: pratap@mecheng.iisc.ernet.in

Dr. Praveen Kumar,
Assistant Professor,
Department of Materials Engineering,
Indian Institute of Science,
Bangalore - 560012
E-mail: praveenk@materials.iisc.ernet.in

Thesis Synopsis: Electromigration is a well-known reliability issue; however, in this project our objective has been harnessing the constructive prowess of electromigration for fabrication and sensing applications. The main goals of the work are:

i. *Development of a new scanning probe lithography technique*:
Using the electromigration driven material flow on thin chromium film, we invented a new low cost lithography technique and named it *electrolithography*. In this process, we perform electromigration induced selective metal etching with the help of a conducting scanning probe, and then transfer the patterns to other materials using a polymer layer. Electrolithography does not require UHV condition, high-power e-beam source or UV sources like conventional lithography techniques.

ii. *Study and control of liquid Electromigration for improving reliability of MEMS devices*:
We have studied electromigration on thin infinite film of chromium, and optimized different device parameters for minimizing electromigration damage.

iii. *Periodic pattern formation on conducting track using electro-thermal force driven material transport*:
We studied electromigration driven material flow through metallic channels and formed periodic ripple patterns using this process. These periodic ripples are successfully used as optical grating for creating diffraction pattern with nanometer resolution.

iv. *Precise control of electromigration for increasing piezoresistive sensitivity*:
Feedback control electromigration on gold metal lines has been used to tune the microstructure of the gold film thereby increasing its resistance and piezoresistive sensitivity.

I hereby declare that the above statements are true to the best of my knowledge and belief.

Date: 21.04.2015