



SOFT NANO TECHNOLOGY

PROF. RABIBRATA MUKHERJEE

Department of Chemical Engineering
IIT Kharagpur

TYPE OF COURSE : Rerun | Elective | UG/PG

COURSE DURATION : 8 weeks (24 Jan' 22 - 18 Mar' 22)

EXAM DATE : 27 Mar 2022

PRE-REQUISITES : Basic Knowledge of Fluid Mechanics will be helpful

INTENDED AUDIENCE : Elective,UG, PG and PhD BE, B Tech, ME, M Tech., MS, MSc, PhD

COURSE OUTLINE :

The fabrication of large area polymer structures with feature sizes ranging from few microns down to the molecular level is key to various technologically important areas, examples of which include molecular electronics, flexible display screens, optical sensors, structural colour, reusable super adhesives, super hydrophobic and self-cleaning surfaces, scaffolds for tissue engineering etc. The meso scale, which ranges from a few nm to few microns, interfaces the molecular and the macroscopic worlds. Thus, it becomes possible to observe simultaneous signatures of molecular interactions as well as macroscopic effects at these length scales, often giving rise to exciting new phenomena. The success of the desired applications, harvesting the extraordinary scientific phenomena occurring at these length scales, depends strongly on the availability of suitable, easy to implement patterning techniques that can create defect-free structures over large areas followed by their accurate characterization. In this course we will learn how to create nano patterns on Soft Surfaces, particularly on Polymer films by various techniques.

ABOUT INSTRUCTOR :

Prof. Rabibrata Mukherjee is presently an Associate Professor in the Department of Chemical Engineering at IIT Kharagpur, where he joined in May 2009. Prior to joining IIT Kharagpur, he was a Scientist at Central Glass & Ceramic Research Institute, Kolkata for 12 years. A B.Tech. from Jadavpur University in 1994 and M Tech from IIT Kharagpur in 2003, Rabibrata obtained his PhD in 2007 from IIT Kanpur, under the guidance of Prof. Ashutosh Sharma. For his PhD thesis he won the prestigious Shah Schulman Best PhD thesis award in colloids and interfacial science from IChE in 2008. His present research interest includes: instability and dewetting of thin polymer films, soft lithography, polymer blends, nano fluidics, organics solar cells, super-hydrophobicity etc. So far, he has published 34 journals papers, some of which are in high end journals such as Nano Letters, Nanoscale, ACS Nano, Advanced Materials, Advanced Functional Materials, Macromolecules, ACS Applied Materials & Interfaces, Langmuir, Soft Matter, Applied Physics Letter, etc. He has also co-authored 5 book chapters and holds 4 Indian Patents. He received the CSIR Young Scientist Award in 2007 and the MRSI Medal in 2014. He also got the best teaching feedback at IIT Kharagpur in 2015 for his course "Instability and Patterning of Thin Polymer Films".

COURSE PLAN :

Week 1: Introduction to Patterning of Thin Films

Week 2: Different Nano Fabrication Regimes including self assembly

Week 3: Discussion on Photo Lithography: Photo Resists

Week 4: Nano Imprint Lithography

Week 5: Soft Lithography: Introduction

Week 6: Soft Lithography Techniques

Week 7: Basic Concepts of Atomic Force Microscopy

Week 8: Different Imaging Modes of Atomic Force Microscopy