

Lithography and patterning of molecules and nanoparticles using Nanotubes

Materials Science, Nanoscience and Analytical Chemistry

Activities for participating students:

Students working in this project will have a unique opportunity to work in a highly inter-disciplinary and collaborative research in nanotechnology and materials science. They will fabricate and characterize nanotube-containing chips using the state-of-the-art analytical techniques such as scanning and transmission electron microscopies. The students will learn and apply fundamental physical principles such as EPF and EOF for the molecular patterns on surfaces. The characterization of the patterns will be performed using fluorescence and atomic force microscopies. The students will also interact and collaborate with other members of the group. The research experience gained by the students will help them be exposed to and contribute to the solution of complex scientific and technological problems in nanotechnology and the analytical and physical chemistries.

Project Description:

In this research project, a proposed novel method for the deposition and patterning of chemical and biochemical molecules and nanoparticles onto flat surfaces at the submicron level will be investigated. Conical nanotube arrays are embedded in an impervious glass matrix, which are used as *nanopens* for the deposition of biomolecules on flat surfaces. The molecules will be transported through electrophoretic (EPF) and/or electroosmotic (EOF) mechanisms onto a surface through the use of appropriate sign and magnitude of applied potential between molecules in the nanotubes and surface. *The main advantages of the proposed system over existing technologies includes its comparative speed, inexpensive process of fabrication, and controlled active and parallel deposition of molecules and nanoparticles at the submicron level on surfaces.* Ultimately, the proposed device will find potential applications in a wide range of fields including materials sciences, bioanalytical chemistry, medicine, drug discovery, and biochemistry. Some applications of the proposed research include probing molecular interactions for catalysis; protein-protein and protein-drug interactions; chemical- and biological sensors; applications in areas such as light-emitting and imaging devices; and alternative energy source devices.

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