Strategies of Lithography for Trapping Nanoparticles

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Abstract—Current research in materials science and engineering continues to drive its attention to systems on the nanoscale. Thin films, nano-particles, quantum dots, nano-wires, etc are just a few of the areas that are becoming important in projects ranging from biomedical transport to nano-gears. Thus, understanding, producing, and creating these systems is also becoming an important challenge for scientists and engineers to overcome. Physically manipulating objects on the atomic scale requires more than just "micro tweezers" to arrange them in a particular system. Another concern is that forces and interactions that could be ignored or approximated at larger scales no longer hold in this regime. It is the goal of this project to use computational models to simulate nano-particles interacting with customized, highly tailored surfaces in order to confine and pattern them to desired specifications. The interactions to be considered include electrostatic attraction and repulsion, hamaker forces, steric effects, dielectric effects of the medium, statistical variability, mechanical induced surface vibrations, etc. The goal is to be able to manufacture such systems for experimentation in order to compare results to the models. If the models do not hold, we hope to understand the origin of these discrepancies in order to create more robust models for this length scale. Lithography, CVD, and chemical etching will be the primary methods used to create these surfaces on glass substrates. TEM analysis will be compared to modeling through various MD program packages.

[Full Text Not Available]