

324e Mapping Potential Energy Landscapes on Patterned Surfaces Using Diffusing Colloidal Probe Microscopy

Hung-Jen Wu, William N. Everett, and Michael A. Bevan

In this work, we describe a novel method that we call Diffusing Colloidal Probe Microscopy (DCPM), which integrates Total internal Reflection Microscopy (TIRM) and Video Microscopy (VM) methods to monitor three dimensional trajectories in colloidal ensembles levitated above macroscopic surfaces. TIRM and VM are well established optical microscopy techniques for measuring normal and lateral colloidal excursions near macroscopic planar surfaces. In past work, we have used these methods to perform simultaneous measurements of particle-surface and particle-particle equilibrium pair interactions on the order of kT using various inverse analyses. We are currently extending DCPM to interrogate potential energy landscapes on patterned substrates to be used as templates for self assembly processes. By chemical and physical micro-patterning of surfaces using silanes and lithographic methods, two dimensional potential energy surfaces are created for assembling particles. With three dimensional information for many particles near patterned surfaces, equilibrium statistical mechanical analyses can be used to interpret particle-surface interactions for specific template locations. Accurately measuring small energy differences in particle-wall interactions on the order of kT for different template locations is crucial to manipulating equilibrium self assembly processes. By employing numerous monodisperse Brownian colloidal probes, DCPM can map potential energy landscapes with improved speed and sensitivity compared to typical scanning probe methods.