Nano-Scale Measurements of Long-Range Interactions in Microfluidic Channel Using AFM with Colloidal Particle Probe

전명석*, R.W. Lovitt[1], W.R. Bowen[1]
한국과학기술연구원(KIST) Complex Fluids Lab;
[1]Centre for Complex Fluids Processing, U. of Wales, Swansea, UK
(mschun@kist.re.kr*)

Long-range interactions are important to understand the physicochemical phenomena of electric field in either micro-biochip or MEMS devices confined to the charged solid wall and to analyze the behavior of complex fluids dispersed by either colloids or nano-particles. Atomic force microscopy (AFM) results were obtained for electrostatic interaction force profiles between a silicon nitride tip and a silica surface by the traditional method as well as between a spherical silica particle and a silica surface employing a colloid probe technique. Distances ranging several tens of nanometers were successfully measured under a contact mode in 1.0 mM KCl electrolyte solution at different pH values. Experimental results obtained by the colloid probe were compared with the calculations from Derjaguin approximation as well as rigorous numerical method. As the separation distance between the silica surface and silica particle is decreased, the approximation under constant potential gives greater interaction than our measured values, with its difference becoming large. AFM results in PDMS-based microfluidic channel are also presented.