Particle size effects on interactions between interface-trapped particles based on optical tweezer measurements

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Typical colloidal particles are irreversibly attached to fluid-fluid interfaces. Such adsorption tends to decrease the interfacial tension, consequently stabilizing the interface. Therefore, solid particles can be good alternatives to molecular surfactants that are expensive and environment-unfriendly. The behaviors of colloidal particles at the interfaces are governed by electrostatics and capillarities. In general, the electrostatic interactions lead to repulsions between the particles due to asymmetric charge distribution across the interface, whereas the capillary interactions cause attractions to minimize the surface free energy. Since the relative strength between the two types of interactions determines the assembled colloidal microstructures and their rheological properties, it is important to quantitatively investigate the magnitude of the interaction forces. In the context of understanding the effect of particle size on the interactions, we fabricate polystyrene particles with controlled size distributions via the microfluidic method, and measure the interactions between the interface-trapped particles with different dimensions using optical laser tweezers.