Direct measurements of interactions between geometrically anisotropic particles at an oil-water interface using optical laser tweezers

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Typical colloidal particles attach to fluid-fluid interfaces owing to the reduction of surface free energy. The particles located at an oil-water interface experience two competitive interactions; one is the capillary interaction due to interface deformation and the other is the electrostatic interaction cause by surface charge on the particles. When spherical particles reside at the oil-water interface, they exhibit abnormally strong electrostatic repulsions that decay as r-4, where r is the center-to-center separation between the particles. In contrast, for geometrically anisotropic particles, the capillary interaction becomes dominant, compared to the electrostatics. In this work, we employ the optical laser tweezers to quantitatively investigate the interactions between nonspherical particles with controlled geometric anisotropies. Furthermore, we clarify the effect of particle configurations with respect to the interface on the interaction magnitude and equilibrium microstructures.