



P.20 Adsorption energies of poly(ethylene oxide)-based surfactants and nanoparticles on an air-water surface

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The self-assembly of polymer-based surfactants and nanoparticles on fluid-fluid interfaces is central to many applications, including dispersion stabilization, creation of novel 2D materials and surface patterning. Very often these processes involve compressing interfacial monolayers of particles or polymers to obtain a desired material microstructure. At high surface pressures, however, even highly interfacially-active objects can desorb from the interface. Methods of directly measuring the energy which keeps the polymer or particles bound to the interface (adsorption/desorption energies) are therefore of high interest for these processes. Moreover, though a geometric description linking adsorption energy and wetting properties through the definition of a contact angle can be established for rigid nano or microparticles, such a description breaks down for deformable or aggregating objects. Here, we demonstrate a technique to quantify desorption energies directly, by comparing surface pressure-density compression measurements using a Wilhelmy plate and a custom-microfabricated deflection tensiometer. We focus on poly(ethylene oxide)-based polymers and nanoparticles. For PEO-based homo- and co-polymers, the adsorption energy of PEO chains scales linearly with molecular weight, and can be tuned by changing the sub-phase composition. Moreover, the desorption surface pressure of PEO-stabilized nanoparticles corresponds to the saturation surface pressure for spontaneously-adsorbed monolayers, yielding trapping energies of $\sim 10^3 k_B T$.

