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General and Rigorous Framework for Particle Adsorption on Fluid Interfaces[1] MARKUS SCHMUCK, Maxwell Institute for Mathematical Sciences and Heriot-Watt University, SERAFIM KALLIADASIS, Imperial College London — Consider two arbitrary immiscible phases where one phase contains small and neutral particles of uniform size on the order of the interface. The wetting properties of the particles are accounted for by the contact angle formed at the interface between the two fluid phases and the particles. Under experimental observations that particles are adsorbed on the interface to lower the interfacial energy and hence the surface tension as well, we formulate a free-energy functional that accounts for these physical effects. By making use of variational methods and a consistent gradient flow formulation, we obtain partial differential equations that systematically describe the location of the interface and the density of the particles in the fluid phases and the interface. Our numerical experiments analyse the time evolution of the surface tension, the particle concentration, and the free energy over time and reflect the crucial property of a decreasing free energy under particle adsorption.

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