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Particle Deposition in Drying Drops of Colloidal Suspensions Containing Different Surfactants[1] TIM STILL, PETER J. YUNKER, A.G. YODH, University of Pennsylvania — When a drop of water containing small solid particles dries, most of the solid material is deposited in a ring-shape stain after evaporation (the so-called coffee ring), driven by initial contact line pinning and a subsequent outward-flow. The fluid dynamics and, hence, the deposition mechanism in such suspensions can be dramatically changed when surfactants are introduced into the system. In a colloidal model-system, the ionic sodium dodecyl sulfate (SDS) produces a concentration-driven Marangoni flow counteracting the outward-flow of the coffee ring effect. SDS locally concentrates at the air/water interface next to the contact line, leading to a reduced local surface tension. Thus, a circulating flow ('Marangoni eddy') is introduced that prevents particles from deposition. This flow is visualized by the movements of the dragged particles using video microscopy. Other surfactants can influence this highly non-equilibrium systems in completely other ways. E.g., the non-ionic Polaxamer block-copolymer surfactants lead to a uniform particle deposition, which we explain by hydrophilization of the colloidal particles. Controlling the solid deposition in drying drops is of major importance for many technical applications.

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