

Effects of Particle Shape on Evaporating Drops of Colloidal Suspensions: From Uniform Coatings to Universal Growth Processes

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Anyone who has spilled a drop of coffee or tea and let it dry is familiar with the coffee ring effect. This effect, wherein suspended particles deposit in ring-like fashion during drying, can be undone by changing suspended particle shape. Micron sized ellipsoidal particles deposit uniformly from an evaporating drop, due to particle-induced deformations of the air-water interface. Interestingly, the growth dynamics of these colloidal deposits contains a deep connection to the mathematical study of interfacial growth processes. As aqueous suspensions evaporate, particles accumulate at the drop's edge, and the deposition front varies spatio-temporally. Measurements of the fluctuations of the deposition front enable us to identify three distinct growth processes that depend strongly on particle shape. Thus, a deep connection between particle shape and evaporative deposition is derived, and a novel engineering tool is established.