

Active-Stratification of Particles with Different Wettability at the Air/Water Interface Using Depletion Force

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Stratified colloidal films composed of two or more different layers combine function of each layer, making them ideal for multi-functional coatings. To fabricate them in a simple and one-step process, dynamic self-stratification exploiting competition between colloidal diffusion and solvent evaporation in drying colloidal films has emerged as a versatile approach. However, this approach requires difference in colloidal particle size, and it is difficult to achieve a uniform coating in large-area due to the “coffee-ring stain”. In this work, a novel technique for fabricating stratified colloidal films uniformly and in large-area without the particle size difference. We spread highly and less hydrophilic particles together on the air/water interface where depletion force is working, and then laterally compress them to selectively desorb the highly hydrophilic particles. The desorbed particles are held underneath the less hydrophilic particle layer, leading to formation of a stratified colloidal film that can be subsequently deposited by the Langmuir-Schaefer method. The composition of the film is controllable depending on the compression level and particle fraction.