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Harnessing size segregation effects in film-forming formulations

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The drying process of film-forming formulations such as paints and coatings involves the assembly of micro and nanoparticles and aggregates in suspension into a film as the solvent evaporates. The ways in which these ingredients are assembled will dictate the architecture of the dried coating and therefore its performance. For example, in the case of antibacterial paint, the amount of bactericidal agent that accumulates at the top surface will determine its effectiveness against microorganisms.

We have proven that in drying blends of large and small colloidal particles, small particles can become trapped near the air-water interface as it moves down [1]. This results in a particle concentration gradient from the top to the bottom of the wet film, which drives large particles to diffuse down. As a result, a stratified colloidal film is formed with an enrichment of small particles at the top and most large particles at the bottom. In this talk, I will describe how we can harness and tune this size segregation process to tailor the final structure of bactericidal[2] and abrasion resistant[3] coatings, as well as recent advances to understand the influence of rheology modifiers on this process. These concepts are applicable to other functional coatings as well as to a wider range of products based on the drying of particle suspensions such as inks, adhesives, or cosmetics.

Keywords: colloids; polymers; coatings; formulation; self-assembly

References:

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