Graduate Student Research Seminar

Spring 2022

Viscous Effects in Particle Filtration of Suspensions via Dip Coating

Connor Copeland (M.S.)
Advisor: Dr. Joshua Bostwick

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3:00 pm (EST) – 132 Fluor Daniel Building

Abstract

When a solid substrate is withdrawn from a liquid bath at a known velocity V, a thin coating of thickness h is deposited. This dip coating process has wide ranging application including optical coating, wire insulation, fiber coating, manipulation of thermal properties, and a variety of biomedical processes, some of which involve particle-laden suspensions. It has been shown that the film thickness is dependent on the coating fluids' viscosity, surface tension, density, and the withdrawal velocity of the substrate, resulting in what is now known as the Landau-Levich Derjaguin (LLD) model. The LLD model well predicts the coating thickness for capillary numbers $Ca<10^{-2}$ when using fully wetting Newtonian fluids. For liquids containing particle suspensions there is a potential for dip coating to be used as a means of capillary filtration where the competition between viscous and surface tension forces can be used as a tunable dynamic filter. In this work, we aim to provide a deeper dive into the physics that govern this capillary filtration technique by performing experiments aimed at understanding the effects of viscosity. Observations include the filtration of i) single-particle suspensions with potential clump formation and ii) bidisperse particle suspensions. Furthermore, we expand on previous work using a larger range of particle sizes and fluid viscosities to broaden the experimentally-determined filtration range.

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