

## Accepted Manuscript

The Suppression of Droplet-Droplet Coalescence in a Sheared Yield Stress Fluid

Sachin Goel, Arun Ramachandran

PII: S0021-9797(16)31054-2  
DOI: <http://dx.doi.org/10.1016/j.jcis.2016.12.055>  
Reference: YJCIS 21889

To appear in: *Journal of Colloid and Interface Science*

Received Date: 21 October 2016  
Revised Date: 21 December 2016  
Accepted Date: 22 December 2016



Please cite this article as: S. Goel, A. Ramachandran, The Suppression of Droplet-Droplet Coalescence in a Sheared Yield Stress Fluid, *Journal of Colloid and Interface Science* (2016), doi: <http://dx.doi.org/10.1016/j.jcis.2016.12.055>

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

# The Suppression of Droplet-Droplet Coalescence in a Sheared Yield Stress Fluid

Sachin Goel<sup>a</sup>, Arun Ramachandran<sup>a</sup>

<sup>a</sup>*Department of Chemical Engineering & Applied Chemistry, University of Toronto, 200 College Street, Toronto, ON M5S 3E5, Canada.*

---

## Abstract

Efforts to stabilize emulsions against coalescence in flow have often focused on modifying properties of the interface between the continuous and dispersed phases, and creating a repulsive barrier against coalescence. But prior to experiencing any interaction force, the liquid film between two colliding drops has to drain, and if this drainage process is arrested, coalescence will be suppressed. In this work, scaling analyses and thin-film lubrication simulations are used to study the hydrodynamic drainage properties of thin films of a Bingham fluid (a yield stress fluid, which flows only when a critical stress is exceeded) created between two drops colliding under the action of a constant force. Our study shows that the hydrodynamic drainage process can be arrested completely when the film reaches a critical thickness, *before* attractive forces result in the rupture of the film, provided that the film shape is in the dimpled configuration. This critical thickness is  $h_f = 6\tau_0^2 R^3 / \gamma^2$ , where  $\tau_0$  is the yield stress of the suspending medium,  $R$  is the drop radius and  $\gamma$  is the interfacial tension between the fluids. The yield stress can thus serve as an independent tuning parameter that sets an upper bound on the drop size beyond which coalescence is turned off in sheared emulsions.

Download English Version:

<https://daneshyari.com/en/article/4985187>

Download Persian Version:

<https://daneshyari.com/article/4985187>

[Daneshyari.com](https://daneshyari.com)