ME – MTech(Res) Thesis Colloquium

Sub-Newtonian coalescence in polymeric fluids

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ABSTRACT

Droplet coalescence is a thermodynamic equilibration process driven by surface energy minimization. The physics of this phenomenon is characterized by the temporal evolution of a liquid bridge formed upon the proximate approach of two droplets. This phenomenon is ubiquitous, manifesting in processes linked to life like raindrop formation, growth of tumor cells, and industrial processes like combustion, spray paintings, and coatings. Despite these universal occurrences, studies on the coalescence of complex fluid droplets remain scarce in the literature. Unlike Newtonian fluids, complex fluids have signature micro-structures that can result in a wide range of responses depending on external perturbations making a unified model elusive. Micro-structure diversity and flow behaviors have classified these into sub-classes ranging from polymers to suspensions. But there has been a recent surge in studies investigating coalescence dynamics in macromolecular-based micro-structure fluids, i.e., polymeric fluids. However, detailed work on developing a theoretical framework for coalescence in complex fluids remains unknown. In the thesis, we propose such frameworks for polymers, suspensions, and dispersions. Based on our theoretical/experimental observations for polymeric fluids, we propose the existence of a new coalescence regime, namely the sub-Newtonian regime with arrested coalescence as its limiting case.

ABOUT THE SPEAKER

Abhineet completed his bachelor's from IIT Kanpur in 2018. To experience industry, he joined Indian Oil Corporation and served as an engineering officer for a year. Following this, he joined the Department of Mechanical Engineering, IISc, in 2019 as a graduate student. He finished his M.tech(Res) degree under the supervision of Prof. Aloke Kumar. His broad research interests include soft materials, fluid mechanics, and mechanobiology.