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Manipulating the breakup dynamics of a droplet by lading nanoparticles in the liquid phase SAPTARSHI BASU, DEEPU P, SHUBHAM CHOWDHURI, Indian Institute of Science — The deformation and breakup characteristics of a 5 μl sessile droplet excited via support motion are studied by employing high speed imaging. The support was actuated in a sinusoidal fashion using electromagnetic means at different frequencies and amplitudes. It is observed that under resonant conditions, the droplet shows vigorous oscillations and eventually disintegrates. Introducing nanoparticles into the liquid phase is seen to suppress the breakup of the droplet. By studying the oscillation behavior of glycerol-water mixtures at different concentrations, the effect of the presence of nanoparticles is established to be tantamount to increasing the fluid viscosity. Frequency spectra of the response (quantified in terms of the droplet height) of the different droplets revealed that higher modal excitation of the droplet is suppressed with increasing viscosity. This non-linear interaction among the higher harmonics explains the increasing trend of phase lag between the driving force and the response as the viscosity increases. A theoretical model based on proper orthogonal decomposition was developed which corroborates all the experimental trends.

Deepu P
Indian Institute of Science

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