Theoretical Studies of Flow-Induced Coalescence

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We study the dynamics of collision and film drainage that leads to coalescence of two drops in a flow. The objective is comparison with experimental observations from our laboratory. The basis is to study head-on collisions with a time dependent force along the line of centers of the drops that varies with time in the same way that the force along line of centers varies with time in a “normal” glancing collision. Experiments carried out with a computer-controlled version of the 4-roll mill demonstrate that the coalescence process in such a head-on collision is identical to that in the corresponding glancing collision for low capillary numbers. The focus on head-on collisions allows a much greater degree of spatial resolution than is possible in a fully 3D collision. Two kinds of theory are discussed: thin-film theory based on the asymptotic limit \( Ca \ll 1 \); and boundary integral calculations.

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