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Breakage, coalescence and droplet size distribution of surfactant-laden droplets in wall-bounded turbulence ALFREDO SOLDATI, GIOVANNI SOLIGO, ALESSIO ROCCON, TU Wien; University of Udine — The dynamics of surfactant-laden droplets in a turbulent channel flow is investigated using direct numerical simulations of turbulence coupled with a two-order-parameter phase-field method; the first-order parameter describes the dispersed phase morphology, while the second one the surfactant concentration. The problem is characterized by the complex interplay among flow field, interface, and surfactant distribution: these three factors are deeply intertwined and determine the overall dynamics of the dispersed phase. Shear stresses deform the interface, changing the local curvature and thus surface tension forces, but also advect surfactant over the interface. In turn, local increases of surfactant concentration reduce surface tension, changing the interface deformability and producing tangential (Marangoni) stresses. Finally, the interface feeds back to the local shear stresses via the capillary stresses, and changes the local surfactant distribution as it deforms, breaks and merges. These complex interactions determine the steady-state droplet size distribution, which is found to be in good agreement with previous experimental observations and numerical simulations.

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