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Using Convective Flow to Reach the Kinetic Limit of Surfactant Transport to a Stationary Microbubble NICOLAS ALVAREZ, Chemical Engineering Department, Carnegie Mellon University, DOUG VOGUS, Chemical Engineering Department, Bucknell University, LYNN WALKER, Chemical Engineering Department, Carnegie Mellon University, SHELLEY ANNA, Chemical Engineering Department, Mechanical Engineering Department, Carnegie Mellon University —
Surfactant transport is characterized near microscale interfaces in the presence of flow. We infer transport mechanisms by simultaneously measuring the radius of and the pressure jump across the interface of a micron size bubble. The surfactant is dissolved in the liquid surrounding the bubble. Flow is introduced to minimize concentration gradients caused by diffusion. The dynamic surface tension is monitored at initially clean interfaces for different flow rates. The kinetic limit is achieved as the flow rate increases. The observed dynamics are interpreted in the context of a scaling analysis and a one dimensional convective transport model. This device and theory will be instrumental in measuring and modeling kinetic exchange dynamics at fluid-fluid interfaces for more complex surface-active species, including mixed surfactants, polyelectrolytes, and biomolecules.

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