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A Microfluidic Tensiometer SHELLEY ANNA, HANS MAYER, Dept. of Mechanical Engineering, Carnegie Mellon University — Recent theoretical predictions indicate that a shift in surfactant transport mechanism from diffusion dominated to kinetically dominated occurs at highly curved interfaces where the radius of curvature is on the same order as feature sizes in microfluidic devices (10 to 100 microns). To date experimental evidence of this shift in transport mechanism has been lacking due to limitations on the degree of interface curvature imposed by traditional methods of surface tension measurement. We show that measurement of dynamic surface tension at highly curved interfaces is possible via a microfluidic tensiometer that uses glass micropipettes to control curvature dimension. We observe a dramatic decrease in the characteristic timescale for reducing the surface tension of an initially clean interface, compared with the timescale observed using a traditional pendant bubble method. We discuss the implications of this shift in timescale toward the determination of relevant physical properties of surfactant systems. The transport of surfactant molecules to and from liquid interfaces plays an important role in the formation and motion of droplets and bubbles in microfluidic devices and the results presented here offer new insight into the relevant mass transport timescales to be considered in such applications.

Shelley Anna
Carnegie Mellon University

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