Microfluidics for Measuring the Equilibrium and Dynamic Interfacial Tensions of Liquid Crystals

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The characterization of the interfacial properties of liquid crystals, particularly of liquid crystals against water, can be challenging to undertake with existing techniques due to the reliance of current techniques on additional data about the liquids in contact, typically the densities and/or viscosities, which may be difficult to determine with precision [1–3]. To overcome this major limitation, we present a microfluidic approach based on the production and aspiration of droplets into a channel. Inspired by the technique of micropipette aspiration on living cells to determine membrane tension [4], our technique generates droplets *in situ* and immediately aspirates them, allowing for interfacial tension data to be obtained from a modified Young-Laplace equation by simply observing the radii of the undeformed and the deformed droplet and measuring the applied pressure necessary to induce such a deformation [5], as shown in Figure 1. We demonstrate that this technique can be applied to measure both dynamic and equilibrium interfacial tensions of liquid crystals, allowing for rapid measurement of interfacial tension with a minimum of material and with a high degree of precision.

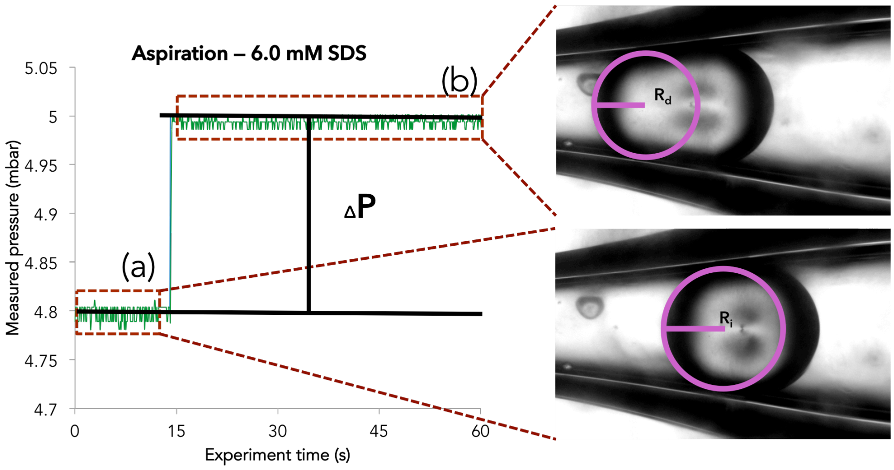

Figure 1: Aspiration of a 5CB droplet in a 6.0 mM SDS (aq) solution. The difference in pressure between the aspirated (b) and unaspirated (a) states, combined with the radii of the corresponding droplets, is used to determine the interfacial tension between the liquids.

References

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