Topology of Relaxed Encapsulated Droplets after Elongation

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Encapsulated drops consisting of one phase completely coating another phase have important applications to control the release in space and/or time of the drop components in many areas such as targeted drug delivery. A projection level set method that describes accurately interface evolution in multiple phase fluids (1) was used to analyze the dynamics of encapsulated drops under shear (2) and the break up of encapsulated droplets relaxing from shear flow (3). In many technologically situations liquid drops experience spatial and/or temporal variations. They can undergo rather large deformations before breaking up under shear; the critical capillary number (shear strength) is denoted by Ca_{cri}. The relaxation of an elongated encapsulated droplet can lead to different drop topologies depending on flow conditions. We examine the deformation and relaxation of drops that have been elongated at a constant shear rate (Ca) to a certain length L.

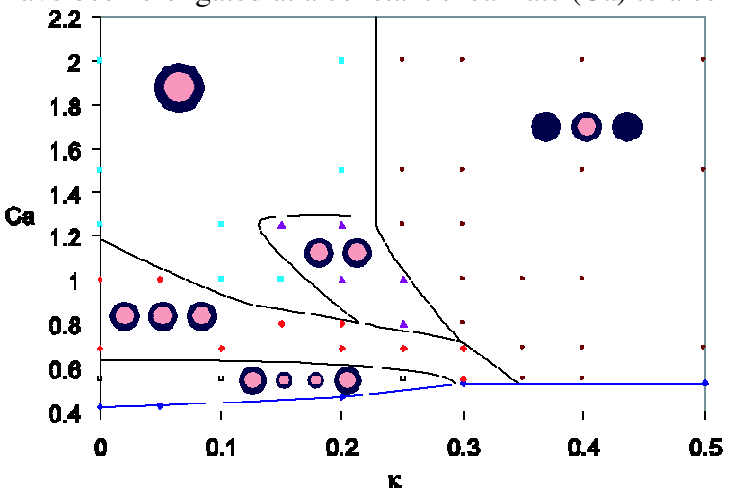

Figure 1. Phase diagram Ca versus κ of an encapsulated droplet. All points represented by the same symbols have topologically similar final morphologies, qualitatively illustrated by the embedded images. The lines are drawn to show approximately the "phase boundaries". The lowest line is the measured $Ca_{cri}(\kappa)$.

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3. K. A. Smith, J. M. Ottino, and M. Olvera de la Cruz, "**Encapsulated Drop Breakup in Shear Flow**," *Phys. Rev. Lett.* **93**, 204501 (2004).