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# Liquid Encapsulation by Binary Collisions of Immiscible Liquid Drops

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**Abstract**

In this paper, we present binary collisions of immiscible liquid drops as a promising and reliable process for encapsulating liquids in shells of other, immiscible liquids. Our current experimental approach describes the collision outcome according to relevant parameters. Aqueous glycerol solutions and silicon oils are tested. Depending on the drop size $D$ and the relative velocity $U$, the impact parameter $x$ and liquid viscosity $\mu$, density $\rho$ and surface tension $\sigma$, we observe that either the full drop of encapsulating liquid spreads around the encapsulated one, or part of it separates, while the rest remains attached. We show that the viscosities of the two liquids do not have equal importance for the stability limit of the process, especially for head-on collisions. We describe a new unstable mechanism replacing reflexive separation, which we term "crossing separation" (*see* Fig. 1). The relative velocity corresponding to this stability limit scales with the viscosity of the coating liquid. For separated drops, the thickness of the remaining liquid shell was also investigated. For off-center collisions where $X=x/D>0.5$ it turns out to be independent of both liquid viscosities and relative velocity. As a consequence, we can accurately adjust the thickness of the coating layer by simply tuning the impact parameter of the collision. An interpretation of this behavior based on a geometric argument is proposed.

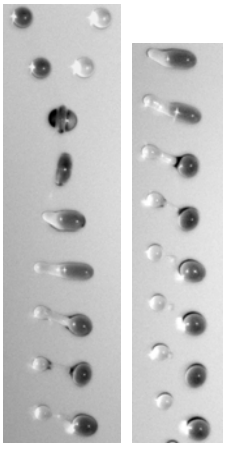

**Figure 1.** Crossing separation of 50% glycerol solution (dark) and SO M3 (bright) drops. $D$=210 µm, $U$=2.75m/s, $X$=0.03.

Key words: drop collisions, immiscible liquids, encapsulation.

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