603e Crystal Comets: Dewetting during Emulsion Droplet Crystallization

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Liquid oil emulsion droplets can violently dewet their own solid crystals during crystallization as a result of surfactant adsorption. The crystal shape formed is a function of the relative rates of dewetting and crystallization as controlled by surfactant adsorption, cooling rate, and lipid purity. For negligible dewetting rates, crystals nucleate and grow within the droplet. At similar crystallization and dewetting rates, the droplet is propelled around the continuous phase on a crystalline “comet tail” much larger than the original droplet. Rapid dewetting causes the ejection of small discrete crystals across the droplet's oil-water interface. It is shown that the crystallization behavior can be precisely controlled by tuning the molecular packing geometry of the surfactant.