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Viscous memory effects on the generation of hierarchical morphologies at an emulsified oil/water interface MELANIE L. MORRIS, MICHAEL C. GROSS, ASMI PANIGRAHI, RYAN M. DEACON, PATRICK CHAN, JASON J. BENKOSKI, Johns Hopkins University Applied Physics Laboratory — A defining feature of biological materials is their fractal morphology. Cancellous bone, pulmonary alveoli, small intestine villi, neural networks, and bladder epithelium are just a few examples of biological structures with hierarchically organized topographies spanning multiple length scales. Herein we present a self-assembly method that faithfully reproduces the topographic features of these biomaterials. The system consists of a photocurable monomer and water. To this quasi-two-component system we add surfactants that sculpt the interface into the desired shape. The resulting structures are then solidi?ed by crosslinking with UV light. Drawing from the rich phase behavior of oil/water/surfactant systems, we demonstrate complex fractal morphologies over many length scales ranging from several mm down to 100 nm. Quantitative image analysis reveals fractal morphologies with at least four distinct levels of hierarchy. Increasing viscosity, in particular, shows a strong correlation with the number of hierarchical levels.

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