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The Science of Mocha Diffusion JUSTIN BURTON, AINSLEY STANCZAK, DEVON BECKER, Emory University, THOMAS VIDEBAEK, University of Chicago — Mocha diffusion is a well-known technique for generating beautiful, flower-like patterns on ceramic surfaces. A thin coating of wet, clay "slip" is first applied to the surface, followed by drops of dark ink with additives such as ethanol or vinegar. The result is a complex fingering pattern. Although one may intuit that Marangoni forces drive the spreading of the ink, we have found that the rheology and thickness of the underlying wet slip plays a critical role. Most importantly, the slip must be shear thinning. We have performed a number of experiments with both clay slip and other fluid systems to explore this phenomena. In the laboratory, we use shear-thinning solutions of sodium alginate or cornstarch and water as the sub-fluid, and drops of food coloring as the spreading fluid. There is an optimal consistency for the sub-phase that enhances fingering. Our preliminary rheology measurements suggest that a competition between Marangoni stress and the onset stress for shear thinning can qualitatively explain the appearance of fingers, but a quantitative mechanism for the initiation of the instability is not yet known. We will also show how mocha diffusion can be used as a great tool for teaching the beauty of fluid mechanics in K-12 classrooms (even virtually).

Justin Burton
Emory University

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