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A framework for simulating precipitate reactions in microfluidic devices[1] PATRICK EASTHAM, NICK MOORE, NICK COGAN, Florida State University — Chemical processes within flows are ubiquitous. There exists an important class of reactions that result in a phase change from liquid to solid: precipitation reactions. Inspired by recent microfluidic experiments, this talk describes a novel mathematical framework for handling such reactions occurring within a slow-moving fluid flow. A key challenge for precipitate reactions is that, in general, the location of the developed solid is unknown a priori. To model this situation, we use a multiphase framework with fluid and solid phases; the aqueous chemicals exist as scalar fields that react within the fluid to induce phase change. To demonstrate the functionality of this framework, we conduct full-scale simulations in a realistic microfluidic geometry. The framework can be applied to precipitate reactions where the precipitate greatly affects the surrounding flow, a situation appearing in many laboratory and geophysical contexts including the hydrothermal vent theory for the origin of life. More generally, this model can be used to address low Reynolds number fluidstructure interaction problems that feature the dynamic generation of solids.

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