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Flow Characteristics of Mixing in Continuous Flow Supercritical Carbon Dioxide Material Synthesis Reactor COURTNEY OTANI, ELIZABETH RASMUSSEN, JOHN KRAMLICH, IGOR NOVOSSELOV, University of Washington — Supercritical carbon dioxide (sCO2) is being increasingly employed for advanced clean energy research including turbomachinery, electronics cooling, and more recently material synthesis. Understanding the fluid mechanics that dictate optimum operation is key to wide-spread application. The research presented here focuses on the mixing section of a continuous flow sCO2 material synthesis reactor. Modeling the transient and multiphase mixing between sCO2 and precursor materials gives insight into optimizing reactor conditions for uniform and controllable crystallization growth. Therefore, the commonly used counter-current design as well as three others are analyzed using computational fluid dynamics (CFD) to determine the flow characteristics of various geometries. Velocity and temperature contour plots and profiles are presented to identify regions with high vorticity, large temperature gradients, areas of stagnation, and boundary layer effects. Comparison of these results highlight the attributes and inefficiencies of different mixing section geometries.

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