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How turbulence affects surface deposition in reactive processes

Benaiah U. Anabaraonye, Jiun C. Ong, Jakob R. Bentzon

Reactive crystallization is fundamental to many industrial systems. The formation and deposition of crystals on surfaces remain poorly understood, especially at turbulent flow conditions. In this work, we present experimental and numerical studies of bulk and surface precipitation kinetics at turbulent flow conditions. Experimental studies were carried out in a Taylor Couette reactor in three distinct configurations to generate a wide range of bulk flow turbulence and wall shear stress. Our numerical approach involves performing unsteady Reynolds-averaged Navier-Stokes (URANS) and large eddy simulations (LES) to model the diffusive and convective transport phenomena in the system. The numerical model predicts the locations of high and low crystal deposition, which are in good agreement with experimental observations. The insights from this study provide new understandings of liquid-phase reactions in wall-bounded systems.

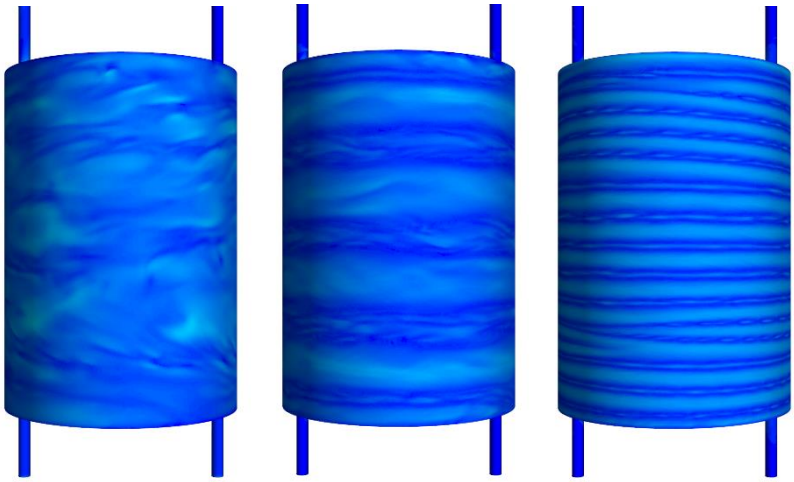

Figure 1. Visualizing shear stress in a Taylor Couette reactor.

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