Computational Fluid Dynamic Simulation of the Dispersed Phase Size Distribution in a Multifunctional Channel Reactor

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Abstract
Empirical or semi empirical models for existing process equipment are seldom reliable when designing new equipment. New concepts based on first principles are needed. In the present work, a combination of computational fluid dynamics (CFD) and populations balance modelling are used to simulate the performance of a novel reactor. The simulations were performed for immiscible liquid-liquid dispersions for a wide range of different hydrodynamic conditions and for systems with different interfacial tension. Each simulation was validated with non-intrusive high speed video measurements of the size distribution. In this work theoretical closures for break-up and coalescence are taken from literature and implemented in a commercial CFD program. It is concluded from this study that by combining CFD and population balance modelling, a powerful simulation tool is obtained that can describe the dispersed phase size distribution under various conditions.

Keywords: computational fluid dynamics, population balance modelling, liquid-liquid dispersion, novel reactors

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