Abstract Submitted
for the DFD09 Meeting of
The American Physical Society

A Microscale Multi-Inlet Vortex Nanoprecipitation Reactor: Turbulence Measurement and Simulation[1] JANINE CHUNGYIN CHENG, Dept. of Chemical and Biological Engr., Iowa State Univ., MICHAEL G. OLSEN, Dept. of Mechanical Engr., Iowa State Univ., RODNEY O. FOX, Dept. of Chemical and Biological Engr., Iowa State Univ. — Microreactors capable of generating turbulent flow are used in Flash NanoPrecipitation, a novel approach to produce functional nanoparticles. Microreactor design and optimization can be greatly enhanced by developing reliable computational models. Scalar mixing in a multi-inlet micro-vortex reactor has been previously studied and a RANS simulation with a scalar mixing model had been successfully validated for fully turbulent flow. To further validate the flow field, the reactor, operated in flow regimes from laminar to turbulent, was investigated using microscopic particle image velocimetry and computational fluid dynamics. In the experiments, instantaneous velocity fields were recorded on three different planes in the reactor and flow statistics such as the mean velocity and turbulent kinetic energy were computed for comparison with flow simulations. Laminar simulations were performed for the low-Reynolds-number cases, and large-eddy simulations (LES) were performed for higher-Reynolds-number cases. The simulation results were in good agreement with experiments for all cases, demonstrating the accuracy of the simulation models in the laminar-turbulent transition range.

[1]NSF CBET0403864 CBET0730250

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Date submitted: 07 Aug 2009 Electronic form version 1.4