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Numerical modeling of turbulent swirling flow in a multi-inlet vortex nanoprecipitation reactor using dynamic DDES JAMES C. HILL, Iowa State University, Chemical and Biological Engineering, ZHENPING LIU, Iowa State University, Mechanical Engineering, RODNEY O. FOX, Iowa State University, Chemical and Biological Engineering, ALBERTO PASSALACQUA, MICHAEL G. OLSEN, Iowa State University, Mechanical Engineering — The multi-inlet vortex reactor (MIVR) has been developed to provide a platform for rapid mixing in the application of flash nanoprecipitation (FNP) for manufacturing functional nanoparticles. Unfortunately, commonly used RANS methods are unable to accurately model this complex swirling flow. Large eddy simulations have also been problematic, as expensive fine grids to accurately model the flow are required. These dilemmas led to the strategy of applying a Delayed Detached Eddy Simulation (DDES) method to the vortex reactor. In the current work, the turbulent swirling flow inside a scaled-up MIVR has been investigated by using a dynamic DDES model. In the DDES model, the eddy viscosity has a form similar to the Smagorinsky sub-grid viscosity in LES and allows the implementation of a dynamic procedure to determine its coefficient. The complex recirculating back flow near the reactor center has been successfully captured by using this dynamic DDES model. Moreover, the simulation results are found to agree with experimental data for mean velocity and Reynolds stresses.

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