CFD Simulation of Aerocyclone Hydrodynamics and Performance at Extreme Temperature

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ABSTRACT
This work presents a Computational Fluid Dynamics calculation to predict and to evaluate the hydrodynamics and performance of a cyclone operating at extreme temperature. The numerical solutions were carried out using commercial CFD code FLUENT 6.1. The simulation was realised using a Reynolds stress model (RSM) for turbulent modelling and discrete phase model (DPM) for particle trajectories calculation. The kinetic theory was employed to predict the physical gas properties, i.e., ρ, Cp and μ as they vary with the operating temperature. The CFD simulations predict excellently the cyclone performance and gas properties at extreme operating conditions with a deviation of about 5% from the experimental data. The physical mechanism for cyclones operating under high temperature has been also successfully elucidated. Results obtained from the computer modelling exercise have demonstrated that CFD is a reliable method of modelling the cyclone performance at extreme temperature. Therefore, similar method can be applied to examine the effects of operating temperature on the cyclone performance. This method of analysis is almost certainly less expensive than experiment, and represents a cost-effective route for design optimisation.
KEYWORDS: cyclone, high temperature, collection efficiency, pressure drop, hydrodynamics

DOI: 10.1080/19942060.2008.11015208