Abstract

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Computational fluid dynamics study of the impact of surface roughness on cyclone performance and erosion

In this study, the effect of roughness of cyclone wall on the rate of erosion and cyclone performance was studied using the CFD technique with the aid of the Ansys-Fluent 19.2 software. The Reynolds stress transport model was used to simulate the airflow turbulence in the rotating flows in the cyclone. The validated computational model was used, and the variations of axial velocity, tangential velocity, collection efficiency, cyclone pressure, and rate of erosion for different wall roughness were evaluated. For simulating surface erosion, the Oka model was used. The result of this study revealed that the wall roughness significantly affected airflow behavior in the cyclone and the resulting cyclone performance. In addition, when the wall roughness increased, the wear rate decreased. It was also found that the solid loading and inlet gas velocity significantly affect the erosion rate and even more than that of particle size.