CFD analysis of Jet driven multiphase flow

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Abstract

In industry, Grinding and size reduction at µm scale can be done by fluidized bed jet mill. The particle-particle impact in expanding gas streams causes the comminution effect. Since the common principle of comminution within such a mill is unclear, their construction and output estimation are largely empirical. Using 2.4 mm i.d. nozzles, the effect of free jet velocity set-up geometry on the initial rate of grinding of soda lime glass of 5.5 µm size was explored. The numerical simulations allowed to better understanding the particle–flow interactions in a fluidized bed opposed gas jet mill, which are crucial for milling process efficiency.

Problem Statement & Methodology

The latest work uses Computational Fluid Dynamics (CFD) technique to investigate the flow behavior of gas-solid phases while milling process in a fluidized bed jet mill. The present work has been carried out using the finite volume based commercial software OpenFOAM (Version 7). The computational domain was meshed using unstructured quadrilateral cells with non-uniform spacing. Due to the expected steep gradients, a very fine mesh was formed close to the jet and wall surface and the mesh was made progressively coarser as we move away from the jet and wall using a specific growth rate parameter. The realisable k–e model modified for turbulent flows is used to concurrently solve the conservation equations of mass, momentum, and energy. Air is tangentially fed to the mill at 1, 2 and 3 m/s through the nozzles.

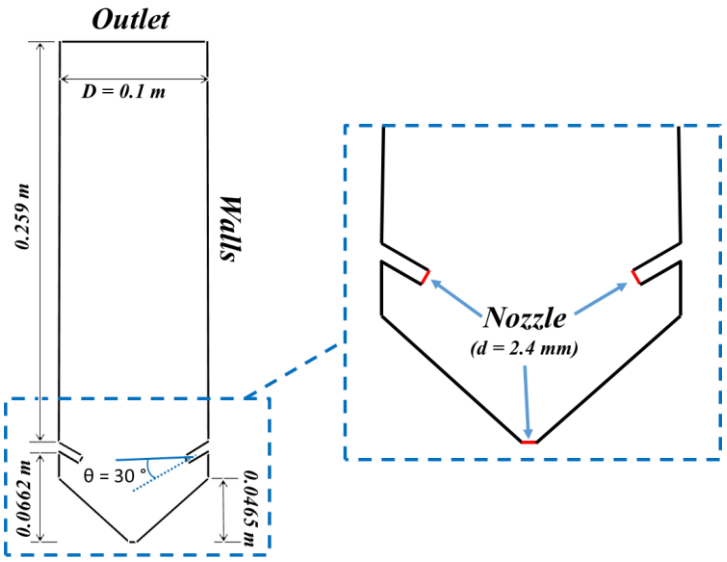

Figure. Schematic representation of the computational domain.