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Numerical Study of Water Mixing in a Conventional Flotation Cell

Debadi Chakraborty

Research & Development Division, Tata Steel
Jamshedpur-831001, Jharkhand, India
debadi.chakraborty@tatasteel.com

Abstract

Flotation is an important and well-established process in the minerals industry. The fundamentals of flotation are, however, not well understood as those of other unit operations in this industry. The performance of a flotation cell is influenced by physical features, such as, impeller, stator and tank design, and by operating conditions, such as, impeller speed and aeration rate. Flotation cells are conventionally designed using empirically derived relations. The efficiency of the flotation process depends highly on the initial contact between the air bubble and the mineral particle. To enhance this contact, flotation cells are designed to achieve good mixing between the suspending solids and the dispersing air.

In recent years, research is going on to use computational fluid dynamic (CFD) modeling of mechanically stirred flotation cells to study the complexity of flows within such machines. To study the detailed hydrodynamics inside a flotation cell, mass, momentum and turbulence quantities are solved. In the present study, a cylindrical flotation tank fitted with the Outokumpu rotor-stator mechanism has been modelled. A commercial CFD software package (FLUENT®) has been used to predict the hydrodynamics inside the flotation tank under steady-state conditions. The fluid (water) properties are assumed to be constant and the same has been considered incompressible. Two mesh blocks have been generated for modelling the rotating impeller and the stationary stator within the tank. Transport equations have been solved using the multiple rotating reference frames technique in the computer code. The standard $k-\varepsilon$ model was used to model the turbulent flow field. The froth layer is not included in the computational domain, only the collection zone is simulated in the study.