Effect of Particle Size Distribution on Fluidization Characteristics in a Fluidized Bed

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Research and development of smelting reduction processes and direct reduction processes without any pretreatment have been conducted as alternatives to blast furnace. Since fluidized bed reactor is appropriate for gaseous reduction with many advantages, to develop a new iron making process in a fluidized bed is an important research topic. In the present study, fluidization characteristics have been determined to provide fundamental data to develop a fluidized bed reduction system. The effects of particle size distributions on the minimum fluidization velocity, axial solid holdup distribution, particle entrainment rate in a fluidized bed were determined. The fluidizing bed material is hematite with a density of 3.98 g/cm^3 and the size range of 0-8 mm. The removal of fine particle under 0.125 mm causes about 30% increase in the minimum fluidization velocity and 75% decrease in the entrainment rate. On the contrary, the removal of coarse particle over 4.75 mm brought about 45% decreases in the minimum fluidization velocity. Solid holdup is in the range of 0.3-0.5 from the distributor to 12 cm height and almost zero above 12 cm with S-shaped curve in the plot of height vs. ε_s. As the gas velocity is increased, the entrainment rate increases exponentially.