学　位　論　文　の　要　旨

Flow Characteristics of a Bubbling Fluidized Bed with Nonspherical Particles

（非球形粒子を用いた気泡流動層の流動特性）

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In practical applications, particles in a bubbling fluidized bed are usually nonspherical in shape. However, traditional research methods often assume that particles in a bubbling fluidized bed are spherical to simplify calculations. This assumption fails to accurately represent the fluidization behavior of particles in the system, which seriously affects the design, optimization, and actual operation of the fluidized bed reactor. Therefore, studying the dynamic characteristics of gas-solid two-phase flow of nonspherical particles in bubbling fluidized beds is crucial.

In this study, we employed experimental methods to investigate the gas-solid two-phase hydrodynamic characteristics of nonspherical particles. The main contents and results of this paper are as follows:

(1) As the particle shape deviates gradually from the spherical, particles tend to form a channeling flow instead of a smooth transition to the bubbling fluidization. The minimum velocity and bed expansion rate initially decrease and subsequently increase with an increase in the aspect ratio. The vertical velocity profiles are sensitive to the aspect ratio at low gas velocity, but not sensitive at high gas velocity.

(2) We identify two high-probability particle configurations, two particles in a parallel or vertical arrangement. We further explain the cause of this order appearance

through entropy theory.

(3) This study examines the impact of particle shape and superficial gas velocity on bubble dynamics and identifies that particle configuration affects the movement and development of bubbles.

In summary, these findings are helpful to reveal the fluidization characteristics of nonspherical particles and promote the understanding of the mechanism of gas-solid flow characteristics of rod-like particles, thus provide a guidance for the design, optimization, and control of fluidized beds.