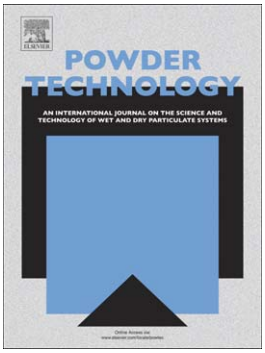

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Effects of Moisture Content on Electrostatic Sensing Based Mass Flow Measurement of Pneumatically Conveyed Particles

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Abstract

Mass flow rate measurement of pneumatically conveyed particles is desirable for the optimal control of many industrial processes. The unpredicted variation of moisture content in particles affects the accuracy of mass flow measurement of particles in enclosed pipelines using electrostatic electrodes. In this study, the characteristics of measured electrostatic signals from particle flow under different flow conditions are analysed to study the effect of moisture content on the mass flow rate measurement. The measurement principle of ring-shaped electrostatic electrodes, the effects of moisture content on electrification of solid particles, and the experimental setup used in the study are presented. Two types of electrostatic electrodes with different axial widths and structure are adopted to measure the electrostatic signals of nonporous glass beads and porous activated carbon powder on the vertical pipeline of a 74 mm bore gas–solid two-phase flow test rig under various moisture content, mass flow rate and conveying velocity conditions. The experimental results indicate that the amplitude and frequency characteristics of the electrostatic signals change with the moisture content. The deviation of mass flow measurement that caused by the variation of moisture content is analysed, and a recalibration process is demonstrated to be effective for the improvement of measurement accuracy.

Keywords: *Gas–solid two-phase flow, moisture content, mass flow rate, electrostatic electrodes, pneumatic conveying, flow measurement*