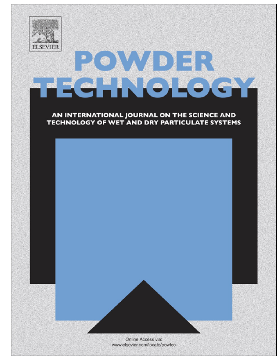

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Stability and Phase Space Analysis of Fluidized-Dense Phase Pneumatic Transport System

Baldeep Kaur[1,2], Anu Mittal[3], Soumendu Jana[2], S.S. Mallick[3]*and Peter Wypych[4]

[1] The Wolfson Centre for Bulk Solids Handling Technology, University of Greenwich, Central Avenue, Chatham Maritime, Kent ME4 4TB, UK
[2]School of Physics and Materials Science, Thapar University, Patiala, Punjab-147004, India
[3]Department of Mechanical Engineering, Thapar University, Patiala, Punjab-147004, India
[4]Faculty of Engineering and Information Sciences, University of Wollongong, NSW-2522, Australia

*Corresponding author. Email address: ssmallick@thapar.edu
Telephone number: +91-175-2393080

Abstract

Fluidized dense-phase pneumatic conveying of powders is gaining popularity in several industries, such as power, chemical, cement, refinery, alumina, pharmaceutical, limestone etc., because of reduced gas flow rate and power consumption, decreased conveying velocities, improved product quality control, reduced pipeline sizing and wear rate, increased workplace safety etc. However, understanding the fundamental transport mechanism of fluidized dense-phase transport has only made limited progress because of the highly concentrated and turbulent nature of the gas-solids mixture. In the present work, pneumatic conveying trials were conducted with power plant fly ash (median particle diameter: 30 μm; particle density: 2300 kg/m^3; loose-poured bulk density: 700 kg/m^3) through 69 mm I.D. x 168 m long pipeline. The mass momentum and energy balance of the system lead to the formulation of governing equations of flow for the dense-phase pneumatic conveying, which were solved using Runge-Kutta-Fehlberg (RKF45) method for different mass flow rates of fly ash and air. The stability of the system has been established corresponding to the four critical conveying parameters: pressure drop, particle