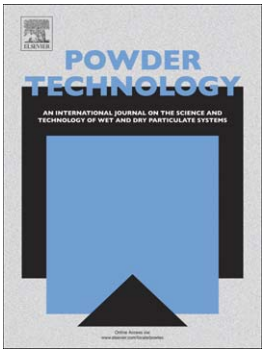


# Numerical Simulation of Flow Behavior of Particles in an Inverse Liquid-Solid Fluidized Bed

Shuyan Wang, Jin Sun, Qian Yang, Yueqi Zhao, Jinsen Gao, Yang Liu

PII: S0032-5910(14)00323-4
DOI: doi: 10.1016/j.powtec.2014.04.017
Reference: PTEC 10178

To appear in: *Powder Technology*

Received date: 10 January 2014
Revised date: 22 March 2014
Accepted date: 4 April 2014

Please cite this article as: Shuyan Wang, Jin Sun, Qian Yang, Yueqi Zhao, Jinsen Gao, Yang Liu, Numerical Simulation of Flow Behavior of Particles in an Inverse Liquid-Solid Fluidized Bed, *Powder Technology* (2014), doi: 10.1016/j.powtec.2014.04.017

# Numerical Simulation of Flow Behavior of Particles in an Inverse Liquid-Solid Fluidized Bed

Shuyan Wang [1,*], Jin Sun[1] ,Qian Yang[1], Yueqi Zhao [1], Jinsen Gao [2], Yang Liu[1]

1 School of Petroleum Engineering, Northeast Petroleum University, Daqing 163318, China

2 State Key Laboratory of Heavy Oil Processing, China University of Petroleum, Beijing 102249, China

* Corresponding author. Tel.: +86 459 6507721; Fax: +86 459 5967161 E-mail address: wangshuyan@nepu.edu.cn

Abstract: Flow behavior of particles is simulated by means of two-fluid model combining with kinetic theory of granular flow in an inverse liquid-solid fluidized bed. The Huilin-Gidaspow drag model is used to obtain the interphase interaction of liquid and solid phases. The virtual mass force is considered in simulations. A detailed description of the model equations used has been presented. Predictions are compared with experimental data measured by Renganathan (2005) in an inverse liquid-solid fluidized bed. This comparison shows that the present model can capture flow behavior of liquid and solids phases in an inverse fluidized bed. The distributions of velocity and volume fraction are predicted at the different superficial liquid velocities. Simulations indicate that axial velocities of particles and the bed expansion height are increased with an increase of liquid velocity. The granular temperature as a function of solids concentrations is computed from simulations. Roughly, the granular temperatures increase, reach maximum, and then decrease with the increase of solids volume fraction. The effects of liquid viscosity and temperature on flow behavior of particles are generally scarce using CFD. Present simulations show the temperature is not main effect on flow of particles in an inverse liquid-solid fluidized bed. The bed height and velocity increase with the increase of fluid viscosity which effects on flow behavior of particles in the bed.

Key Words: Two-fluid model; liquid-solid; inverse fluidized bed; simulation