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PII: S1385-8947(17)30212-7
DOI: http://dx.doi.org/10.1016/j.cej.2017.02.055
Reference: CEJ 16494

To appear in: *Chemical Engineering Journal*

Received Date: 2 November 2016
Revised Date: 7 February 2017
Accepted Date: 8 February 2017

Please cite this article as: Z. Li, T.C.E. Janssen, K.A. Buist, N.G. Deen, M. van Sint Annaland, J.A.M. Kuipers, Experimental and simulation study of heat transfer in fluidized beds with heat production, *Chemical Engineering Journal* (2017), doi: http://dx.doi.org/10.1016/j.cej.2017.02.055

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Abstract

As a result of highly exothermic reactions during gas-phase olefin polymerization in fluidized bed reactors, difficulties with respect to the heat management play an important role in the optimization of these reactors. To obtain a better understanding of the particle temperature distribution in fluidized beds, a high speed infrared (IR) camera and a visual camera have been coupled to capture the hydrodynamic and thermal behavior of a pseudo-2D fluidized bed. The experimental data were subsequently used to validate an in-house developed computational fluid dynamics and discrete element model (CFD-DEM). In order to mimic the heat effect due to the exothermic polymerization reaction, a model system was used. In this model system, heat is released in zeolite 13X particles (1.8–2.0 mm, Geldart D type) due to the adsorption of CO_2. All key aspects of the adsorption process (kinetics, equilibrium and heat effect) were studied separately using Thermogravimetric Analysis (TGA) and Simultaneous Thermal Analysis (STA), and subsequently fluidized bed experiments were conducted, by feeding gas mixtures of CO_2 and N_2 with different CO_2 concentrations to the bed, where the total heat of liberation could be controlled. The combined infrared/visual cam-

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