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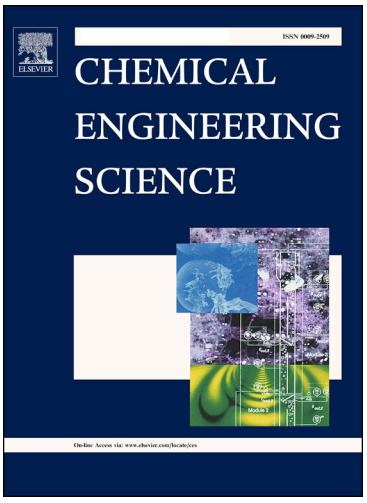

General correlation for maximum heat transfer to surfaces submerged in gas-fluidized beds

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ACCEPTED MANUSCRIPT

GENERAL CORRELATION FOR MAXIMUM HEAT TRANSFER TO SURFACES SUBMERGED IN GAS-FLUIDIZED BEDS

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ABSTRACT

A general correlation is presented for predicting maximum heat transfer coefficient for surfaces submerged in gas-fluidized beds. It has been verified with data for horizontal and vertical cylinders and spheres in beds of a wide variety of particles and gases. The gases include air, cryogens, methane, CO_2, ammonia, and R-12. The rage of parameters includes: heat transfer surface diameter 0.05 to 220 mm, particle diameter 31 to 15000 μm, pressure 0.026 to 0.95 MPa, and temperature 13 to 1028 ^{o}C. The 363 data points from 53 sources are predicted with a mean absolute deviation of 16.2 %. Several other correlations were also compared to the same data but had much larger deviations.

KEY WORDS

Fluidized beds; heat transfer; cylinders; spheres; correlation

1. INTRODUCTION

Heat transfer to surfaces submerged in gas-fluidized is involved in many chemical and industrial processes as well as in power generation. For proper design of such heat exchangers, accurate methods for predicting heat transfer are needed. With increasing gas velocity above minimum fluidization, heat transfer coefficient reaches a maximum and then decreases with further increase in velocity. Many methods, theoretical and empirical, have been proposed for predicting maximum heat transfer coefficient. These include one by the present author, Shah (1983). Since the publication of that paper, many more experimental studies and predictive techniques have been published. The present work was undertaken to compare data to published correlations to evaluate their accuracy and to develop a more accurate correlation if the published ones are found inadequate. The results of data analysis showed that none of the available correlation was satisfactory over the entire range of parameters. Hence a completely new correlation was developed. It was verified with data for cylinders (tubes or wires) with their axes oriented horizontal or vertical, and also spheres (such as balls) in beds of a wide variety of

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