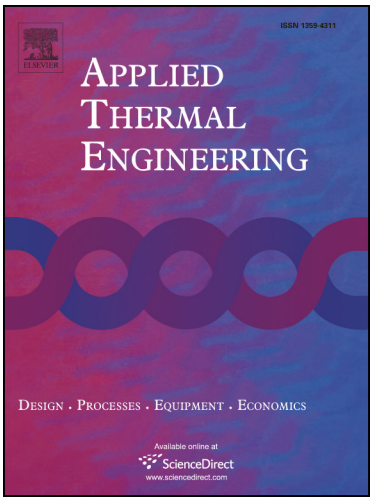

Experiment study on heat transfer characteristics of dusty gas flowing through a granular bed with buried tubes

Shaowu Yin, Jing Li, Guangsi Shi, Feiyang Xue, Li Wang

PII: S1359-4311(18)33349-0
DOI: https://doi.org/10.1016/j.applthermaleng.2018.09.115
Reference: ATE 12724

To appear in: *Applied Thermal Engineering*

Received Date: 18 June 2018
Revised Date: 15 September 2018
Accepted Date: 26 September 2018

Please cite this article as: S. Yin, J. Li, G. Shi, F. Xue, L. Wang, Experiment study on heat transfer characteristics of dusty gas flowing through a granular bed with buried tubes, *Applied Thermal Engineering* (2018), doi: https://doi.org/10.1016/j.applthermaleng.2018.09.115

Experiment study on heat transfer characteristics of dusty gas flowing through a granular bed with buried tubes

Shaowu Yin[a,b,*], Jing Li[a], Guangsi Shi[c], Feiyang Xue[a], Li Wang[a,b]

[a] School of energy and environmental engineering, University of Science and Technology Beijing, Beijing 100083

[b] Beijing Key Laboratory of energy saving and emission reduction in metallurgical industry, University of Science and Technology Beijing, Beijing 100083

[c] College of mechanical engineering, University of Science and Technology Beijing, Beijing 100083

Highlights

1 Heat transfer coefficient increases by 12% after filter particle filling compared to the case where no particles were added in granular bed.
2 Increasing air velocity 50 %, increased the heat transfer coefficient by 46%.
3 Heat transfer coefficient increases by 22% after the introduction of dust particles compared with a pure gas flowing through the granular bed.
4 Under the experimental conditions, temperature changes of the bed layer after three-layer heat exchange tubes fluctuate little, at about ± 3℃.

Abstract: This paper reports an experimental study of the heat transfer characteristics of dusty gas flowing through a granular bed with buried tubes. The effects of the dust concentration and the flow velocity on the temperature distribution of the bed layer are investigated. Then, the heat transfer model between flue gas and cooling medium is established using the logarithmic mean temperature difference to deal with the temperature data of the bed layer, and the influences of filter particle filling, dust concentration, and airflow velocity on the comprehensive heat transfer coefficient are analyzed. Results show that filter filling and increasing the dust concentration and air velocity can enhance the comprehensive heat transfer between flue gas and cooling medium. Under the same conditions, the heat transfer coefficient increases by 12% after filter particle filling. When the dust concentration increases from 2,000 mg/m^3 to 4,000 mg/m^3, the heat transfer coefficient increases by 16%. When air velocity increases from 0.3 m/s to 0.6 m/s, heat transfer coefficient increases by 51%. Under the experimental conditions, the temperature changes of the bed layer after three-layer heat exchange tube fluctuate little. Experienced formula of heat transfer coefficient versus dust concentration and gas velocity has been also proposed.

Keywords: embedded granular bed, dusty gas, bed temperature, heat transfer characteristics

1 Introduction

Ash blockage, wear corrosion, the low efficiency of waste heat recovery and dust removal have become more and more serious in high temperature dusty gas dedusting[1]. In addition, the high-temperature dusty gas often contains coagulating dust particles (like tar and alkali metal