04-W-110

Particle Size Effect on the Heat Transfer Coefficient in a CFB Heat Exchanger System

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Summary

Heat recovery from flue gas from industrial furnaces, boilers and incinerators for better use of energy resources is a nation-wide concern in Korea. To overcome the fouling of fly ash on the heat transfer surface and erosion and periodical cleaning which are the major drawbacks in conventional heat exchangers for flue gas heat recovery, a single riser non-baffle plate circulating fluidized bed (CFB) heat exchanger is devised. The heat transfer performance and pressure drop have been evaluated through experiments for the gas-to-water lab scale heat exchanger system. An experimental investigation was carried out to study the effects of fluidized bed on heat transfer for a single riser heat exchanger. The role of particle diameter and suspension density on heat transfer coefficient were investigated. In the present study, heat transfer from a solid suspension to the wall of a CFB heat exchanger was studied experimentally with glass beads (commercially designated as JB-700, diameter range 425-850㎛, S.G. 2.62) of three mean sizes in the range of 400 to 800 ㎛. The experimental results show that the heat transfer coefficient in this circulating fluidized bed was found to increase with increasing suspension density and decreasing particle size which in general agrees with the results from the previous research works.

The major influence of suspension density on the heat transfer coefficient was observed with particle size effect. This effect become larger for smaller particles and increasing suspension density. The relevant mathematical correlation was proposed to estimate the heat transfer coefficient from suspension density and particle size. This proposed correlation can predict heat transfer coefficient for this system within 10% error. As concerns future research, a suitable correlation will be proposed for this CFB heat exchanger system with the effects of different material using for riser construction.

References

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