HEAT TRANSFER CHARACTERISTICS IN A SMALL-SCALE FLUIDIZED BED BOILER

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Abstract

Heat transfer characteristics in a small-scale fluidized bed boiler ($2MW_{th}$) were studied using lignite and corn cob as fuels. Depending on air velocity, the heat transfer rates from bed to water membrane wall and from hot flue gas to convective tube bank were in the ranges 75-55% and 25-45% of the total heat absorbed by the boiler, respectively. At designed capacity, the heat transfer flux based on bed cross sectional area and on water membrane wall area were about 0.45 and 0-15 MWm^{-2}, respectively. Under the conditions studied, it was found that the overall heat transfer coefficient between bed and water membrane wall was 100-300 W m^{-2} K^{-1}, whereas that between flue gas and convective tube bank was 10-30 Wm^{-2} K^{-1}. The study of heat transfer to a horizontal tube immersed in the bed as well as placed in the freeboard region were also studied. The effective heat transfer coefficients were found to be 300-800 W $m^{-2}K^{-1}$ for in-bed tube and 30-150 W $m^{-2}K^{-1}$ for the freeboard region, depending on air velocity. Comparison of these data with those predicted by both modelling and correlation reported in the literature was also made. For the immersed tube, good agreement was observed for low air velocity, while at high air velocity the experiment produced results twice those estimated from modelling and correlation. For the freeboard region, the model gave a fair prediction.

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