Numerical Simulations of a Circulating Fluidized Bed for Oxy-Fuel Combustion of Plastic Waste

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Gas flow and solid particle behaviors in the circulating fluidized bed are affected by various factors. These hydrodynamic characteristics directly affect the heat transfer phenomena. Consequently, the combustion reaction of plastic waste is influenced by the heat transfer characteristics. Finally, efficiency of the reactor may change. Hence, comprehensive understanding is required about the hydrodynamic characteristics, heat transfer phenomena and their relation in the circulating fluidized bed reactor for obtaining the optimal design and operation conditions of the combustor. Accordingly in the present study, numerical simulations of the circulating fluidized bed combustor for plastic waste under the oxy-fuel condition were conducted by using computational fluid dynamics. Especially, the influences of ratio of plastic to fluidizing media on the hydrodynamic characteristics and consequent heat transfer phenomena were examined. In addition, effect of fluidizing gas components was also scrutinized. Depending on the mass ratio of each species, different particle behaviors were observed. In addition, since the initial temperatures of plastic waste and fluidizing media were different, heat transfer rate from sand to plastic waste particles should be affected by mass fraction of each species. And it could be identified by temperature distribution in the circulating fluidized bed.

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