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Wall Heat Transfer Coefficient in a Molten Salt Bubble Column: Testing the Experimental Setup

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Abstract

One of the advantages of bubble columns is high heat transfer rates. High heat transfer is important in reactors when high thermal duties are required. An appropriate measurement of heat transfer coefficient is of primary importance for designing reactors that are highly exothermic or endothermic. This paper presents the design and operation of an experimental setup used for measuring the heat transfer coefficient in molten salt media. The experimental setup was operated with tap water, heat transfer oil 32, LiCl–KCl eutectic and argon gas. Tap water was operated at a temperature of 40oC and heat transfer oil was operated at temperatures of 75oC, 103oC and 170oC. There were some challenges when operating the bubble column with molten salt due to leakages on the welds and aggressive corrosion of the column. All the experiments were run at superficial gas velocities of 0.01–0.05 m/s. Three heating tapes, each connected to a corresponding variable AC voltage controller, were used to heat the column media. Heat transfer coefficients were measured by inducing a known heat flux through the column wall and measurement of the temperature difference between the wall and the contents. In order to balance the system, heat was removed by the cooling water flowing through a copper tube on the inside of the column. Temperature differences between the column wall and the liquid were measured at five axial locations. It was found that the heat transfer coefficient increases with superficial gas velocity. The values of heat transfer coefficient for argon–water system were higher than those of argon–heat transfer oil system. Heat transfer coefficients were also found to increase with an increase in temperature.