ICE SLURRY PRODUCTION WITH A CIRCULATING FLUIDIZED BED HEAT EXCHANGER

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ABSTRACT

High investment costs of commercially available ice slurry generators have limited a widespread application of ice slurry technology up to now. The fluidized bed ice slurry generator is an interesting alternative since it reduces investment costs and can be operated with high heat transfer rates.

Previous work on the fluidized bed ice slurry generator focused on the stationary mode in which steel particles are kept inside the heat exchanger tubes. Circulation of the particles via a downcomer tube shows some interesting advantages such as more flexibility in operating parameters. As the steel particles are circulated, the hydrodynamics of the fluidized bed change significantly. In contrast to stationary fluidized beds, for example, the radial particle distribution is not uniform in circulating fluidized beds. It is likely that these different hydrodynamics result in changes in heat transfer performance and in stable operation ranges.

First experiments of a circulating fluidized bed ice slurry generator are presented in this paper. Stable ice slurry production was possible showing high heat transfer coefficients up to 3500 $W \cdot m^{-2} \cdot K^{-1}$ and producing ice crystals of about 100 to 500 μm in size. Heat transfer coefficients and stable operating ranges were compared to experimental results from stationary operations. Predictions of heat transfer models from literature were compared to measured heat transfer coefficients.