Fluid Flow and Heat Transfer Characteristics of Microencapsulated Phase Change Material Slurry in Turbulent Flow

Microencapsulated phase change material (MPCM) slurry is consisted of a base fluid in which MPCM is dispersed. Due to apparent high heat capacity associated with phase change process, MPCM slurry can be used as a viable heat transfer fluid (HTF) for turbulent flow conditions. Heat transfer and fluid flow properties of the slurry in turbulent flow (3000 < Re < 6000) were determined experimentally. Dynamic viscosity of the MPCM slurry was measured at different temperatures close to the melting point of the material (20–30°C). Pressure drop measurements under turbulent flow conditions were recorded for 6 MPCM samples at various concentrations. The pressure drop of the MPCM slurry was comparable to that of water despite the higher viscosity of the slurry. The effect of heat flux, MPCM mass concentration, flow rate and the type of phase change material was investigated. The effective heat capacity of slurry at the location where phase change occurs was found to be considerably higher than that of water. A nondimensional Nusselt number correlation was proposed in order to facilitate design of heat transfer loops with MPCM slurries as working fluid. [DOI: 10.1115/1.4026863]

Keywords: microencapsulated phase change material, turbulent flow, pressure drop, constant heat flux