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A Characteristic Study on the Start-up Performance of Molten-Salt Heat Pipes: Experimental Investigation

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Abstract

This paper reports a fundamental experimental investigation of the start-up characteristics of heat pipes using a dedicated molten-salt mixture as the working fluid. Based on four single salt, i.e. NaNO₃(AR), KNO₃(AR), LiNO₃(AR) and Ca(NO₃)₂(AR), a quaternary molten-salt working fluid was developed and charged at different masses into four heat pipes with the same dimensions of 980mm in length and 22mm in diameter. A parallel comparison on the Start-up performance of these heat pipes was then conducted to observe the influence of the charging mass and the inclination angle under the consistent lab-controlled conditions. The experimental results showed the heat pipe with molten-salt charge of 40g responded much quicker than those with molten salt charge of 60g, 70g and 80g respectively; meanwhile, the molten-salt heat pipe achieved the maximum condensation temperature at inclination angle of 50°. Comparing to the conventional naphthalene heat pipe, the dedicated molten-salt heat pipe had a much shorter Start-up time when they were charged with the same amount of 40g. The overall research result is expected to provide certain guidance for further design and operation of molten-salt heat pipe in high-and-medium-temperature heat transfer and storage scenarios.

Keywords: Molten salt; Heat pipe; Inclination angle; Charge mass; Start-up performance

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