* Title: Enhancing Latent Heat Energy Storage with Heat Pipe-Metal Foam: An Experimental Investigation of the Partial Filling Strategy

A. Jaisatia Varthani[1], S. Shasthri[1], Baljit Singh[2], and V. Kausalyah[2]

[1]Heriot-Watt University Malaysia
[2]Universiti Teknologi MARA

April 23, 2024

Abstract

Melting and solidification of a phase change material (PCM) is investigated experimentally by applying a partial filling strategy to the hybrid enhancement of heat pipe-metal foam (HP-MF) in a vertical cylinder. HP-MF enhancement can improve the heat transfer capacity of the PCM system as it combines HP's efficient heat transfer capacity with MF's highly effective thermal conductivity capability. The experimental results demonstrate that the partial filling strategy in the melting and solidification of HP-MF PCM can be optimized for effective MF utilization in the HP-MF PCM system. A filling ratio of 83% of MF in HP-MF PCM shows almost identical total melting and solidification along with a temperature distribution to that of an HP-MF PCM (95% porosity, 20 pore density (PPI)). It is plausible to conclude that the removal of 33% or less mass had no significant effect on the overall melting process of HP-MF PCM. It should be noted that the HP-MF PCM system's heat pipe heat transfer efficiency significantly decreased during the melting process when the MF filling ratio was 37.5% and 12.5%.

Hosted file

`Manuscript.docx` available at https://authorea.com/users/773463/articles/863448--title-enhancing-latent-heat-energy-storage-with-heat-pipe-metal-foam-an-experimental-investigation-of-the-partial-filling-strategy