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Experimental Investigation for Optimization of Geometric Parameters in Heat Pipe Embedded Latent Heat Thermal Energy Storage

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The work has been undertaken to investigate the effect of geometrical parameters of heat pipe on the melting and solidification rate in heat pipe embedded latent heat thermal storage. The numerical model is validated with experimental data obtained by experimental investigations that have been performed on the test unit with technical grade paraffin as the phase change material (PCM) and water as the heat transfer fluid (HTF). Numerical predictions match the experimental results. A series of numerical calculations have been done in order to analyses the influence of length and diameter on the heat transfer process inside the water-paraffin latent thermal energy storage (LTES) unit. Numerical model was developed to calculate the dimensional length and external diameter of storage. The investigation shows that increasing in length and diameter increases the melting and solidification rate thereby increases the heat transfer rate. Increased geometric parameter decrease the charging density. The experimental results that could be used for operating conditions and geometry optimization provide guidelines for the design of the latent thermal energy storage system. Design optimization of this system makes it more attractive for solar thermal storage applications.

Keywords : Pin-fin, Hollow Pin-fin, solid pin fins, Natural convection, Thermal Performance