Songgang Qiu, J Aeronaut Aerospace Eng 2017, 6:3 (Suppl)
DOI: 10.4172/2168-9792-C1-019

Numerical and experimental evaluation of novel heat pipe design for use in thermal energy storage applications

Songgang Qiu
West Virginia University, USA

The main limitation in the widespread implementation of solar thermal power generation is the lack of energy storage to overcome transients in incoming solar insolation. Although the use of phase change materials for latent heat based thermal energy storage is an improvement over sensible heat storage systems, the materials used have low thermal conductivities that limit the heat transfer rate during charging and discharging. One method to enhance the heat transfer rate is to embed heat pipes into the PCM. Heat pipes are an efficient means of transferring energy at high rates under nearly isothermal conditions by utilizing the vast amount of energy released during condensation/evaporation. However, the complex multiphase heat transfer makes it difficult to accurately model their behavior. A novel numerical model was derived that is able of capturing the heat transfer in unconventional geometries that experience non-uniform condensation. This would extend the range of the model and aid in the design of complex heat pipe networks. In order to validate the model, a series of experiments were conducted that examined the effect of working fluid fill volume, input hear, and inclination angle had on the thermal performance of the heat pipe. Strong agreement between the numerally predicated operating temperature and the experimentally recorded value were obtained. This lends confidence that the applied numerical method is capable of capturing the fluid dynamics and multiphase heat transfer that occurs within a complex heat pipe network allowing it to be used for full scale system optimization.

Biography

Songgang Qiu has completed his PhD from University of Minnesota and continued Post-doctoral studies for a year. He is a Professor of Mechanical Engineering at West Virginia University. He has served as the Principal Investigator for more than three dozen research projects. His research focus is in thermal-fluids, energy efficiency, energy conversion and energy storage.

songgang.qiu@mail.wvu.edu

Notes: