Investigation on melting thermal resistance of PCMs applied in roof structures	
Authors	**LMQ Nguyen, Mohamed Bechir Ben Hamida, Ahmad Hajjar, Mohsen Izadi, Mikhail A Sheremet**
Publication Year	2024
Grant Number	IMSIU-RP23081
DOI link	10.1016/j.tsep.2024.102649

Abstract: Reducing energy losses from building walls can be an important part of energy resource management. Here, various structures of building roofs are investigated in order to find the best structure to reduce energy waste. Four different structures in which phase change materials (PCM) are tested and compared. The effect of various parameters, including Stefan and Rayleigh numbers, which depend on the difference between the inside and outside design temperature of the building, has been investigated. In order to study the problem, the Navier-Stokes equations, as well as the energy equation through the solid structure of the roof and the equations related to melting process and energy transport for phase change materials applied in the roof structure, have been solved. The outcomes mainly show that using one block of PCM in the roof structure leads to faster melting compared to multiple layers. A 200% increase in the melting speed is achieved when a single PCM block is located right above the hot boundary. Adding a hollow brick between the hot source and the PCM block leads to the highest thermal resistance. It is also shown that increasing Rayleigh and/or Stefan numbers enhances the heat transfer, PCM melting and melted PCM flow intensity. The melting speed increases 4 and 8 times on average when Stefan number is changed from 0.01 to 0.12, for Rayleigh number of 104 and 106, respectively. Also, for low Stefan number, the melting speed is almost 100% higher on average when Rayleigh number is raised from 104 to 106. the average Nusselt number can be doubled in the optimal configuration when Rayleigh number is increased from 104 to 106, for high Stefan number.

هـ-خوجه