

The Design and Implementation of a Calorimeter for Evaluation of the Thermal Performance of Materials: The Case of Phase Change Materials

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Abstract : The use of thermal energy storage (TES) as part of a passive design strategy can reduce a building's energy demand. TES materials do this by increasing the lag between energy consumption and energy supply by absorbing, storing and releasing energy in a controlled manner. The increase of lightweight construction in the building industry has made it harder to utilize thermal mass. Consequently, Phase Change Materials (PCMs) are a promising alternative as they can be manufactured in thin layers and used with lightweight construction to store latent heat. This research investigates utilizing PCMs, with the first step being measuring their performance under experimental conditions. To do this requires three components. The first is a calorimeter for measuring indoor thermal conditions, the second is a pyranometer for recording the solar conditions: global, diffuse and direct radiation and the third is a data-logger for recording temperature and humidity for the studied period. This paper reports on the design and implementation of an experimental setup used to measure the thermal characteristics of PCMs as part of a wall construction. The experimental model has been simulated with the software EnergyPlus to create a reliable simulation model that warrants further investigation.

Keywords : phase change materials, EnergyPlus, experimental evaluation, night ventilation

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