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Thermal performance evaluation of energy efficient plaster panel using infrared thermography

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Thermal storage systems are one of the most efficient technologies for saving energy resources. As one of the preferred thermal energy storage methods, latent heat energy storage (LHTES) using phase change materials to store and discharge thermal energy is considered to be the most effective and the most promising. Phase change materials (PCMs) have been actively studied as materials that can most effectively utilize latent heat energy storage. The PCM is defined as a substance that is capable of storing or releasing thermal energy at a constant temperature during the phase change process. However, application of PCM becomes difficult in various fields due to phase instability in the liquid phase, and therefore PCM requires shape stabilization. In this study, PCM was inserted into hollow gypsum using varnish to form a layer to prevent leakage during phase change. In addition, exfoliated graphite nanoplatelets (xGnP) with high thermal conductivity were mixed to overcome the low thermal conductivity of organic PCM. The thermal properties of the PCM/xGnP composites were characterized by TCi thermal conductivity analyzer and differential scanning calorimetry (DSC). The thermal behavior of the hybrid hollow PCM/plaster composite panels was also evaluated by infrared thermography analysis. The heat exchanger was constructed using a constant temperature water bath to observe the thermal behavior of the specimens during the heating and cooling process. The experimental conditions were a total of 6 hours of thermal behavior per one cycle, through cooling at 15 °C for 3 hours, and heating at 40 °C for 3 hours. The thermal behavior of the specimen was recorded at 5 minute (min) intervals using an infrared camera by FLIR T420bx. Time-lased thermographic images were analyzed using FLIR software.

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