Laboratory-scale studies on smart gypsum composite boards incorporated with nanoencapsulated organic phase change material for thermal comfort building application

ABSTRACT

An experimental study is presented examining the preparation and characterization of a smart gypsum composite board for thermal comfort building application. Composite boards were prepared by mixing 1-30% by weight nano-encapsulated n-octadecane phase change material (PCM) with gypsum to develop gypsum-based building materials with thermal energy storage (TES) capability. The nanocapsules were prepared by encapsulating n-octadecane in nano-sized styrene-methyl-methacrylate copolymer shells using one-step mini-emulsion in situ polymerization. A thermal performance testing device was designed to evaluate the heat storage effect of the resulting gypsum composite. The results indicated that composite boards containing n-octadecane nanocapsules effectively decreased the temperature peak of the experimental test room compared with gypsum board without n-octadecane nanocapsules. This suggested that the composite boards had good thermal energy storage properties. It was also demonstrated that the composite boards containing n-octadecane nanocapsules containing n-octadecane nanocapsules containing n-octadecane nanocapsules in gypsum for thermal energy storage properties. It was also demonstrated that the composite boards containing n-octadecane nanocapsules in gypsum was more beneficial than adding more than 10% by weight.

Keyword: Building material; n-Octadecane nanocapsules; Phase change material; Smart gypsum; Thermal energy storage; Thermal properties