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Applications of Phase Change Material in highly energy-efficient houses

Edwin Rodriguez-Ubinas [a] ... Javier Neila [b]

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Abstract

Thermal mass combined with other passive strategies can play an important role in buildings energy efficiency, minimizing the need of space-conditioning mechanical systems. However, the use of lightweight materials with low thermal mass is becoming increasingly common. Phase Change Materials (PCMs) can add thermal energy storage benefits to lightweight constructions. There are many studies about the use of PCM in buildings, but there are still some difficulties for effective use and practical application of these materials. The study of applications used in real buildings could help us find solutions to these difficulties. This paper analyzed different PCM applications presented in highly efficient lightweight construction houses that have participated in the American Solar Decathlon, an international competition organized by U.S. Department of Energy. These houses have been tested and monitored in Washington DC, place with suitable climate conditions for short term thermal storage systems. The study started with a

classification of the PCM applications and included an analysis of the systems, materials, switching temperatures, containments and design strategies used to improve the houses energy performance. Also, it included results of numerical simulations and experimentation that the participant team had done, complemented with information available in the literature about similar materials or applications.

Highlights

â–º Study of PCM applications in real buildings help to solve difficulties in its use. â–º Solar Decathlon competition houses have been selected as case studies. â–º Analyzed houses have used innovative latent thermal energy storage solutions. â–º Results show that PCM applications may help to improve the interior thermal comfort.

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Keywords

Energy efficiency; Energy storage; Latent heat; PCM; Phase change; Solar Decathlon; Thermal mass

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