

Numerical Heat Transfer Analysis of a Phase Change Material (PCM) - Enhanced Plaster

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Abstract

Heat transfer analysis of novel building materials, such as Phase Change Materials (PCMs), is a challenging task due to their unique thermochemical properties and the complexity of their operation. The aim of this work is to investigate the thermal performance and impact of a novel Phase Change Material (PCM) - enhanced plaster via the heat transfer analysis of a building wall under summer dominant conditions. For the implementation of the numerical simulation study, three - dimensional (3D) time - dependent building wall models, incorporating the PCM - enhanced plaster, have been developed in COMSOL Multiphysics® (Figure 1). The numerical analysis uses the Heat Transfer with Phase Change feature from the Heat Transfer Module to examine transient temperature transfer in the PCM - enhanced plaster incorporated on the building wall. This paper will primarily provide experimental validation of the numerical simulation results; it will also deliver results regarding the thermal performance of PCM - enhanced plasters with different PCM concentrations (by weight) at different seasons (Figure 2). The research will offer fundamental knowledge and important guidance on the conduction of numerical heat transfer modelling incorporating phase change materials, and it will provide significant conclusions on the design optimization of PCM - enhanced plasters for use in different climatic conditions.

This paper is based on the work conducted by the authors under the research project "Phase Change Material (PCM) enhanced plaster for upgrading the energy efficiency of contemporary and historic buildings - PCPLASTER" (KOINA/ M-ERA.NET/1012; Budget: 100K Euros), funded by the Cyprus Research Promotion Foundation (RPF).

Figures used in the abstract

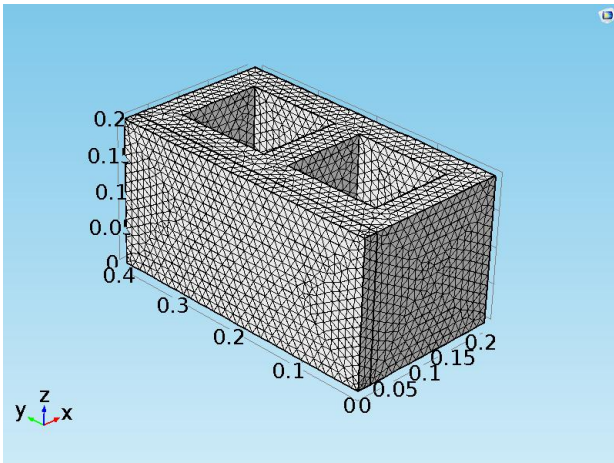


Figure 1: Three - dimensional (3D) geometry and discretization model of a building block unit incorporating the novel PCM - enhanced plaster.

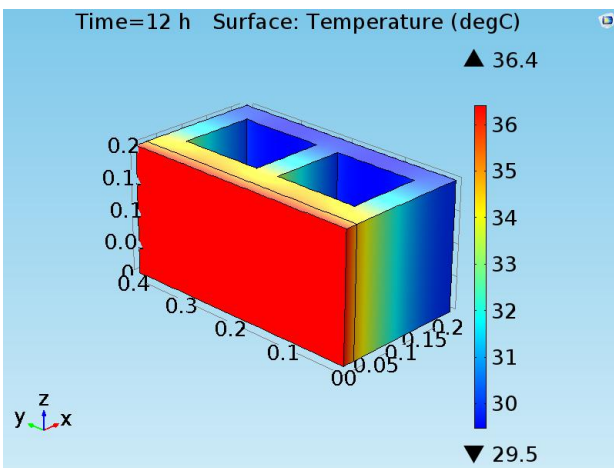


Figure 2: Three - dimensional (3D) time - dependant heat transfer analysis of a building block unit incorporating the novel PCM - enhanced plaster.