Thermally enhanced mortars towards high-end efficient buildings

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The European Green Deal sets ambitious measures to tackle climate change, achieving climate neutrality and a green economy in Europe by 2050, stressing the importance of research in innovative solutions. Incorporating Phase Change Materials (PCMs) into building applications is a promising strategy for achieving indoor thermal comfort while promoting energy efficiency in a sustainable way. Targeting the reduction of overheating in lightweight construction whilst promoting indoor passive thermal regulation, two microencapsulated PCMs with different operating temperature ranges were selected for the development of two innovative thermally enhanced mortars. The mortars are suitable for indoor applications in new and existing buildings, able to compensate the lack of thermal inertia of lightweight construction as well as the loss of thermal mass related to the common application of thermal insulation as the most inner surface of the envelope walls, due to architectural constraints in retrofit design.

Experimental research was performed for: microstructure evaluation; mechanical and thermal properties characterization and thermal conductivity. Additionally, real scale lightweight demonstrators were built in the scope of the SUDOKET project (INTERREG SUDOE) and continuous monitoring of indoor temperatures and energy consumption was performed.

Results revealed a reduction in mechanical properties, however suitable for coating applications. Regarding thermal analysis, the monitored data from the real scale applications revealed lower temperature fluctuations for summer and shoulder seasons with indoor temperatures reduced up to 3°C and a time delay of 1.5h during the cooling period.

The developed PCM enhanced mortar increases thermal storage allowing the mortar to discharge energy for longer periods, attenuating indoor temperature fluctuations promoting energy savings, revealing high potential for this solution to be used as indoor coating towards high-end efficient buildings.

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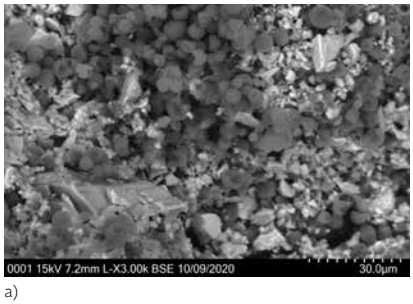
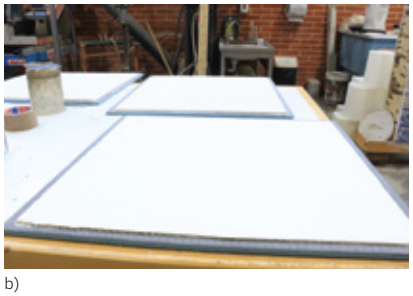
FIGURE 1
Thermally enhanced mortar: (a) SEM image of the microstructure; (b) development and application of the mortar in support panel.

FIGURE 2
Thermally enhanced mortar: (a) applied as indoor coating of the real scale demonstrator; (b) thermal conductivity evaluation in the hot box setup.



a)



b)

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