Heat capacity and thermal conductivity of PCM-enhanced concrete

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Thermal properties of ten concrete mixtures were measured by a Hot Disk thermal constant analyzer. Thermal conductivity, thermal diffusivity and volumetric heat capacity measurements, were performed using the method based on the Transient Plane Source (TPS), as recognized in ISO 22007-2 [1-3].

This technique is generally used to characterize a wide variety of common materials, such as wood, self-compacting concrete with polypropylene fibers [4,5], and cement composites containing various types of rubber [6], for applications in thermal energy storage and building materials.

In general, evaluating the thermal properties of heat storage materials is a fundamental step in sizing and determining the performance of TES systems, including those based on concrete, [7].

The concrete mixtures studied by Enea, as sensible heat storage media, include different types: a basic mix, two mixes with 8–9% of mEPCM (solar salts), and others that contain conductive fibers and aggregates made from industrial waste, such as steel slag and carbon fibers from filters.

Thermal conductivity of 20 concrete cubic specimens with dimensions of 150 mm, was estimated. The experiments were performed at room temperature up to 100 °C. The cubic specimens were placed inside the oven to avoid temperature fluctuations caused by air drafts around the samples.