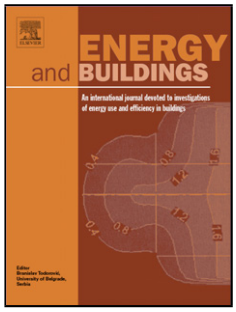

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<AT>Thermal analysis of melting and freezing processes of phase change materials (PCMs) based on dynamic DSC test

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<ABS-HEAD>Highlights► The influence of heating/cooling rate was analyzed. ► Incongruent freezing process of various constituents was observed in PCMs mixtures. ► Difference between incomplete and complete thermal processes was found and analyzed.

<ABS-HEAD>Abstract

<ABS-P>Phase change materials (PCMs) have been extensively studied for thermal energy storage systems and passive thermal control in building applications. Currently, phase change temperature range, even enthalpy as a function of temperature and effective specific heat capacity of PCMs are measured prevalently by DSC test. But it has been reported that the DSC results are dependent on the measuring conditions, especially the heating/cooling rate. In addition, thermal analysis of incomplete phase change processes are scarcely reported, but is frequently appeared in the real PCMs applications. The current research mainly focused on the discussion of the heating/cooling rate of the DSC results, incongruent freezing processes of some commercial PCMs made up with various constituents, and the analysis of incomplete phase change processes including of partly melting, partly freezing as well as partly melting and freezing cases. It is observed that the results were greatly affected by the heating/cooling rate, but whether the ones acquired under a slow rate are exactly that in the real PCMs applications still remain to be proved. Additionally, the DSC curves were incredibly different and abnormal for the incomplete phase change processes, and the thermal-storage capacity was significantly discounted, compared with the complete ones.

<KWD>Keywords: Phase change materials (PCMs); differential scanning calorimetry (DSC); thermal analysis; heating/cooling rate; incomplete phase change process; incongruent freezing