Processing and characterisation of calcium sulphoaluminate ecocements containing Microencapsulated Phase Change Materials

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Calcium SulphoAluminate (CSA) cements can be considered as ecocements, since their production releases up to 40% less CO_2 than Ordinary Portland Cement (OPC) [1]. In addition, Microencapsulated Phase Change Materials (MPCM) are receiving a growing attention in the last years for their capability of storing and releasing high energy (latent heat storage) at a narrow temperature range. Thus, the use of CSA ecocements blended with MPCM would let control the inner temperature of buildings. This would allow a double reduction of CO_2 emissions due to the use of CSA rather than OPC, and the better reconditioning of houses, with the consequent social, economic and environmental benefits.

This work is focused on the dispersion of MPCM in a CSA ecocement matrix and the further characterisation of the corresponding materials. All the important parameters evolved in the preparation of homogeneous CSA pastes and CSA+MPCM pastes were optimised (e.g. percentage of superplasticiser) through rheological studies. MPCM particles were well dispersed in the paste and were kept unaltered in the matrix. The thermal analysis confirmed the phase change properties of the blended cement pastes. In addition, a CSA paste was successfully coated by CSA+MPCM paste, supporting the technical viability of this type of coatings in buildings. Finally, the optimal thickness of a coating of CSA+PCM mortar adhered in a typical building located in Malaga (south of Spain) was theoretically calculated to avoid/minimise the use of air conditioning/heating, resulting in an economically viable project with a considerable reduction of CO_2 emissions.

[1] M.A.G. Aranda, A.G. De la Torre, Sulfoaluminate cement, in: F. Pacheco-Torgal, S. Jalali, J. Labrincha, V.M. John (Eds.), Eco-efficient concrete. Woodhead Publishing Limited, Cambridge, 2013.