

## SILICA MICROCAPSULES ENCAPSULATING EPOXY COMPOUNDS FOR SELF-HEALING CEMENTITIOUS MATERIALS

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### ABSTRACT

Cement based materials are one of the most common materials in construction. These materials show good compression properties and they are relatively inexpensive, which make them ideal for use in big quantities. However, formation of micro-cracks that might develop into cracks could lead to a catastrophic failure impairing their life cycle. Furthermore, if micro-cracks connect with one another, they form a network that could facilitate the permeability of ions which can deteriorate the structure.

In recent years, research has been focused on the development of self-healing cementitious matrix [1-8] in order to improve the durability of these heterogeneous materials without external monitoring or human intervention.

This study examines the suitability of silica microencapsulated epoxy sealing compound as a healing system for cementitious materials. Silica microcapsules, instead of their polymeric counterparts, have been selected since the chemical nature of silica microcapsules makes them more likely to be compatible with the cementitious matrix than organic microcapsules, therefore obtaining a better interface with the cementitious matrix. It is expected that silica microcapsules will withstand the very alkaline environment of the cement matrix better than organic ones, as well as the mixing process in the preparation of cement paste.

This poster describes the synthesis and characterisation of silica microcapsules with epoxy compounds, as well as their addition to the cement paste. Both Diglycidyl ether bisphenol A and a commercial epoxy compound (Epothin<sup>®</sup> from Buehler) have been microencapsulated. A sol-gel reaction to obtain the silica shell followed by an emulsion reaction to encapsulate the organic compound was carried out based on a work by Anh *et al.* [9]. The microcapsules have been characterised by several techniques such as FT-IR spectroscopy, scanning electron microscopy (SEM) and the particle size distribution by light scattering. Figure 1 shows two scanning electron micrographs of the microcapsules encapsulating an epoxy compound.

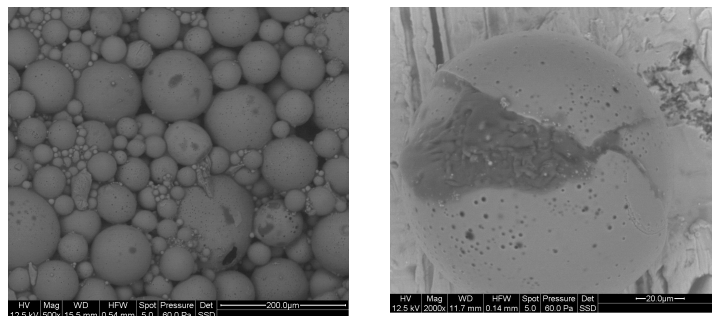


Figure 1: SEM micrographs showing silica microcapsules encapsulating an epoxy compound.

Cement pastes with microcapsules encapsulating epoxy compound have been prepared and their dispersion in the cementitious matrix and their durability in the alkaline matrix through time, as well as the mechanical properties of the paste, have been studied. Figure 2 shows an SEM micrograph of a cement paste with microcapsules.

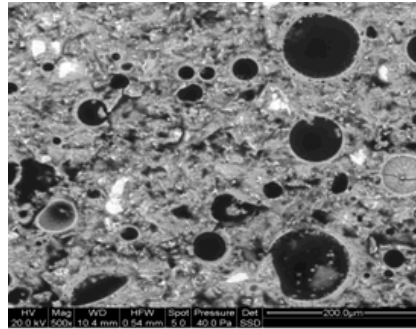


Figure 2: SEM image of cement paste containing silica microcapsules containing an epoxy compound after 90 days of hydration.

Furthermore, this poster will also address the capability of the microcapsules to break when a fracture is formed and of the sealing compound to flow into the cracks.

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