CERIS Civil Engineering Research and Innovation for Sustainability

Performance of silica nanoaerogel-based renders

PhD student
António Armando Ortiz Soares

PhD program
Civil Engineering (IST, University of Lisbon)

Supervisor
Inês Flores-Colen (CERIS, IST, University of Lisbon)

Co-supervisor
Jorge de Brito (CERIS, IST, University of Lisbon)

Period
2013-2018

Funding
FCT scholarship (SFRH/BD/97182/2013)

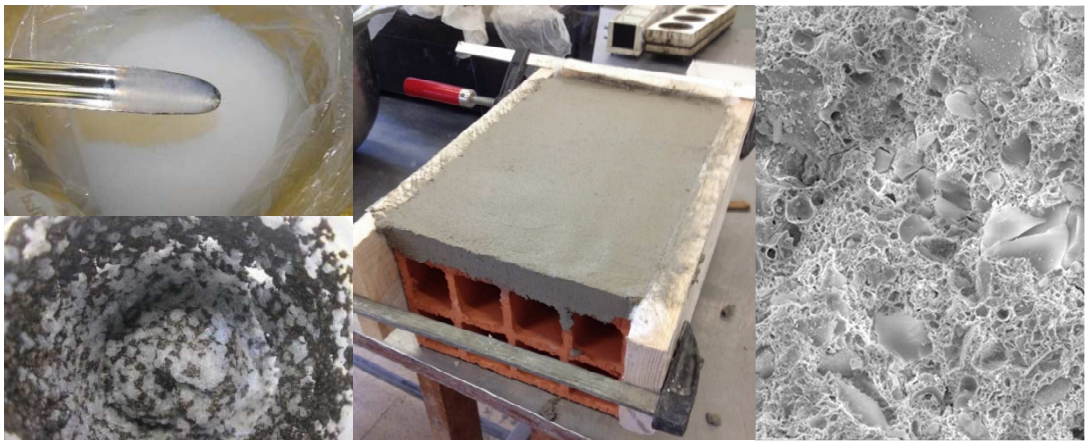
Summary

It was intended to increase the scarce knowledge about the use of silica-based aerogel in cement-based renders. By incorporating silica-based aerogel granules into cement mortars, it is expected to take advantage of the properties of this material (with thermal conductivity between 0.004 and 0.030 W/(m.K)) to obtain renders with good thermal insulation properties. It was also studied the applicability of these renders, particularly suitable for the rehabilitation of current buildings. Compared to a conventional coating mortar, aerogel mortars are expected to significantly increase the thermal efficiency of buildings, but without changing the aesthetics of facades or the useful areas of buildings. The PhD work involved the testing of mortars, with different types (hydrophilic and hydrophobic) and dosages of aerogel, in order to determine formulations with significant improvements of the thermal, using the least possible amount of aerogel.

It was also intended that effective use of aerogel in cement-based materials does not adversely affect the remaining properties of the product and that it is compatible with current building techniques. To achieve this goal, ways of incorporating aerogel in a dispersed manner were developed. After a good stabilization of silica-based aerogel within the binder matrix, in order to reduce the silica-based aerogel amount it was used other lightweight aggregates and by-products in cement replacement to achieve acceptable thermal properties and maintaining a good balance between this and the remaining properties relevant to a thermal render. To understand the role of the aerogel, in render's performance, the morphology and porous structure of aggregates and renders were analysed and correlated with render's properties.

Keywords

Silica-based aerogel, thermal render, lightweight aggregates, lightweight renders, thermal insulation, cement-based.



Production, application and microscopic analysis of aerogel-based renders.