XVI CNMAT2022 CIUDAD REAL 28JUNIO 01JULIO
Congreso Nacional de Materiales

IMMOBILISATION OF A SURROGATE RADIOACTIVE SALT WASTE IN GEOPOLYMERS AND PC-BASED CEMENTITIOUS SYSTEMS

Ines Garcia-Lodeiro[1], Francisca Puertas[1], Jan Hadrava [2], Vojtěch Galek[2], Anna Černá[2], M. Cruz Alonso[1]

1. Eduardo Torroja Institute for Construction Science (IETcc-CSIC), Madrid, Spain
2. Research Centre Řež (CVŘ), Husinec-Řež, Czech Republic

This research explores the possibility of incorporating a surrogate radioactive waste (based on molten salts) on the properties of two types of cementitious systems: i) a Portland cement based material and ii) a novel "one-part geopolymer". The surrogate waste was composed by mixture of different types of inorganic salts (carbonates, chlorides and sulphates) and therefore an impact on the properties of the cementitious systems was expected.

As traditional binders, a CEM I/42.5 SR and a CEM III/B 32.5 were selected, the latter with a high blast furnace slag (BFS) content. The novel cementitious systems was based on "one-part geopolymer", prepared with mixtures of metakaolin (MK) and BFS as a precursors, and NaOH and Na_2SiO_3 powders, as solid activators. The surrogate waste was incorporated in both cementitious systems in ratios of 10 and 30 % with respect to the weight of the cement.

The mechanical strengths, after incorporation of the residue, were determined in paste prismatic specimens after 3, 7 and 28 days of curing (99% RH, 21^{o}C). Changes in microstructure were evaluated by MIP and BSEM/EDX, and the nature of the products formed are analysed by XRD. The effect of residue incorporation on the hydration/activation of the cementitious systems was studied by isothermal conduction calorimetry.

Results show that the chemical composition of the waste highly affects the development and behaviour of the cementitious systems. Mechanical strengths substantially decline and the microstructure is clearly affected, especially in samples containing 30% of the waste. The formation of an expansive salt limits the incorporation of this residuum up to 10%.

Acknowledgements

Authors thanks the EU project "PRE-DISposal management of radioactive waste ". The project has received funding from the Euratom research and training programme 2019-2020 under grant agreement No 945098