Synthesis of Inorganic Polymers from Metallurgical Residues

Production of Portland cement, an essential building material for the construction industry worldwide, is a significant source of energy-related and process-related CO_2 emissions. The suggested figures for cement's industry footprint vary between 5 to 7% of the global anthropogenic carbon dioxide emissions. Major international concern over how to reduce CO_2 emissions has given rise, within the scientific community, to a growing interest in the development of materials and technologies able to reduce the impact of Portland cement and make construction a more sustainable industry. Alkali-activated binders, produced by alkalis mixed with silica- and alumina-containing materials such as kaolinitic clays, metakaolin or industrial waste (fly ash and blast furnace slag), seem to have a high potential.

Inorganic polymers are typically X-ray amorphous aluminosilicate materials that consist of a random three-dimensional tetrahedral network of aluminate and silicate units, with charge balance being achieved by the presence of alkali metal ions. They are conventionally formed by alkali hydroxide or alkali silicate activation of a solid precursor at near-ambient temperatures. The resulting inorganic polymer cures to form a hard, durable material that can be used as an alternative to Portland cement for applications in adverse environments such as high temperature or, alkaline environments or for the encapsulation and disposal of hazardous wastes.

In this project, 22 different industrial residues were received from the partners for investigating their potential as precursors for the synthesis of inorganic polymers.

Overview

The project objective was to test potential of several industrial wastes to be valorised in the production of monolithic building materials and also to acquire fundamental basic knowledge on the behavior and performance of inorganic polymers.

Researchers

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