Goldschmidt 2025 Abstract
https://doi.org/10.7185/gold2025.29428

Increasing the end-of-life value of fibre cement

SELMA KUHLMANN, PETROS KANELIS AND SUSAN STIPP

Technical University of Denmark

The cement industry is a major contributor of CO_2 emissions, thus a contributor to the risk of climate change on our planet [1]. In addition to its initial impact at the time of production, demolition waste is not yet recycled to the extent it should be, with landfill being the end-of-life for half the waste [2]. Fibre cement, with its superior strength and structural properties, also has the challenge of including fibres, which can also contaminate the environment. Our aim was to explore the CO_2 uptake capacity of fibre cement and to determine if the fibres, particularly the polymers, could be removed for recycling, to add end-of-life value to the material.

We have characterised fibre cement, with particular emphasis on investigating the behaviour and properties of the fibres. We have used scanning electron microscopy (SEM) to visualise the material (Figure 1) and energy dispersive X-ray spectroscopy (EDXS) for chemical mapping. X-ray florescence spectroscopy (XRF) provided chemical composition, X-ray diffraction (XRD) was used for mineral composition, N_2 adsorption (BET) for surface area estimation, thermogravimetric analysis (TGA) (Figure 2) with Fourier transform infrared spectroscopy (FTIR) for determining the CO_2 content and the mass fraction of fibres, the Archimedes principle for density determination and the hydrometer method for particle size analysis.

Fibre strength and the strength of attachment of the cement to the fibres are critical parameters, both for the original product and for the propensity of separating the fibres from the waste for recycling, especially if the waste material is crushed or milled. Results suggest a high potential for CO_2 mineralisation of the cement portion because of the high calcium content.

[1] C. Tam (2009) Cement Technology Roadmap 2009: Carbon emissions reductions up to 2050

[2] European Commission (2011) Report on the management of construction and demolition waste in the EU 2.

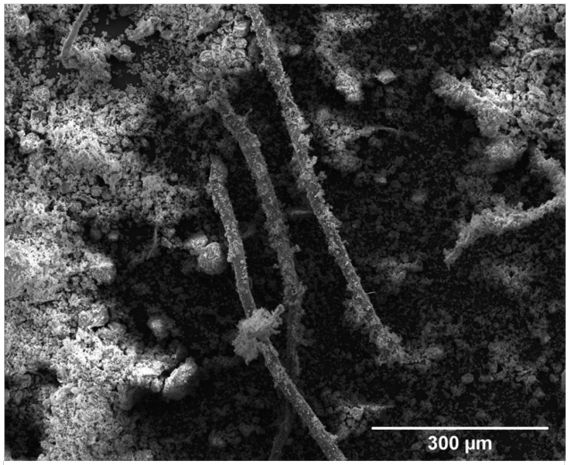

Figure 1: A secondary electron SEM image of fibre cement powder.

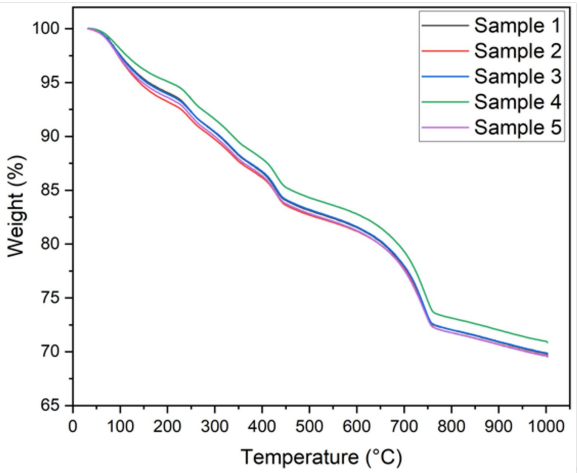

Figure 2: TGA results for 5 samples.