

## Quality Control of Distinct Cements by IR Spectroscopy: First, insights into Perspectives and Opportunities

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**Abstract :** One key factor in achieving net zero emissions along the cement and concrete value chain in Europe by 2050 is the use of distinct constituents to produce improved and advanced cements. These cements will contain e.g. calcined clays, recycled concrete fines that are chemically similar as well as X-ray amorphous and therefore difficult to distinguish. This leads to enhanced requirements on the analytical methods for quality control regarding accuracy as well as reproducibility due to the more complex cement composition. With the methods currently provided for in the European standards, it will be a challenge to ensure reliable analyses of the composition of the cements. In an ongoing research project, infrared (IR) spectroscopy in combination with mathematical tools (chemometrics) is going to be evaluated as an additional analytical method with fast and low preparation effort for the characterization of silicate-based cement constituents. The resulting comprehensive database should facilitate determination of the composition of new cements. First results confirmed the applicability of near-infrared IR for the characterization of traditional silicate-based cement constituents (e.g. clinker, granulated blast furnace slag) and modern X-ray amorphous constituents (e.g. calcined clay, recycled concrete fines) as well as different sulfate species (e.g. gypsum, hemihydrate, anhydrite). A multivariant calibration model based on numerous calibration mixtures is in preparation. The final analytical concept to be developed will form the basis for establishing IR spectroscopy as a rapid analytical method for characterizing material flows of known and unknown inorganic substances according to their material properties online and offline. The underlying project was funded by the Federal Institute for Research on Building, Urban Affairs and Spatial Development on behalf of the Federal Ministry of Housing, Urban Development and Building with funds from the 'Zukunft Bau' research programme.

**Keywords :** cement, infrared spectroscopy, quality control, X-ray amorphous

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