

A calorimeter for the investigation of (new) construction materials

The process that starts when cement is mixed with water and hardens is called hydration, and the formed minerals are therefore called hydrates as they include water in their crystal structure. This transformation releases heat. A calorimeter is an instrument that measures the heat released from these chemical reactions, which in turn provides information on the ongoing reactions. The measured data can be used to follow the cement chemistry and reaction rates of cementitious materials in detail and allows the understanding and hence tailoring of key material properties. Practical examples for topics of interest are the time period when the material is liquid – and can be worked with - or the developing strength in the following days.

Today, a steadily increasing number of possible supplementary cementitious materials, such as calcined clays or by-products of other industries, are being investigated to reduce the cement content of concrete. Supplementary cementitious materials reduce the embedded CO₂ footprint of cementitious construction materials as they reduce the cement quantity used while participating in the hydration reactions. Concrete is globally the most produced artificial material and therefore a significant contributor to CO₂ emissions. Traditionally used supplementary cementitious materials, like coal fly ash, are not available in large enough quantities to reduce the CO₂ footprint of concrete sufficiently for world production. Researchers at DTU are investigating alternative materials to fill this demand while providing concepts that may lead to incorporating material flows of the construction industry into circular economy concepts.

Combining the calorimeter with other experimental methods and modeling tools will allow us to document, understand, and tailor new and established cementitious materials to benefit technology, science, education, society. During our investigations, we address several sustainable development goals such as innovation and infrastructure as well as sustainable cities and communities.