

A new additive in Portland cement – Fragmentation residues from scrapped cars –

Bachelor's / Master's thesis project in co-operation with Stena Recycling

Introduction

A major challenge for the cement manufacturers is to provide a construction material with high performance and low environmental impact. Today, the cement production provides comprehensive CO₂-emission and energy consuming manufacturing processes. There are no trends that show that the demand for cement or cement-like materials will decrease, rather the contrary. During the last five years, the annual world production of cement clinker have increased from 2.6 billion tons to 3.6 billion tons.

There is extensive research around the world to develop and produce alternative additives that to some extent may substitute clinker in cement and thus reduce CO₂ emissions during production. The use of new additives will lead to more cement products with lower clinker content. However, there may be problems with new binder and filler materials in cement. Despite the good mechanical properties of the manufactured concrete, important physical properties such as moisture migration in the material radically changed depending on the amount and type of added material. Long-term effects such as corrosion of rebar, initiated by increased carbonation of concrete, are difficult to predict, which could lead to miscalculations in the concrete's service life. There is therefore a need for basic chemical and physical knowledge of how different additives interact with the cement matrix of concrete.

Aim of the project

In this project fragmented waste from scrapped cars will be tested as a potential additive in Portland cement. This kind of additive is complex and an understanding how it interact with the cement matrix is therefore of vital importance. The follow will be investigated:

- Effect of the additive on the hydration kinetics of cement by using FTIR-spectroscopy and isothermal calorimetry.
- Micro- and macrostructure of the hydrated cement matrix by using SEM
- Composition of the fragmented residue SEM, ICP and XRD

Methods

The main methods in this project are infrared spectroscopy, isothermal calorimetry, scanning electron microscopy, X-ray diffraction and ICP-MS. However, depending on the development of the project and the preferences of the student, other methods can also be used.

Organisation

The project is performed by one student or several students working on different parts of the project. The work may be carried out as a 15hp or 30hp or degree project.

For more information please contact:

Rikard Ylmén, rikard.ylmen@chalmers.se

Ulf Jäglid, ulf@chalmers.se

Energy and Materials
Chemical and Biological Engineering