Accepted Manuscript

Influence of nucleation seeding on the performance of carbonated MgO formulations

N.T. Dung, C. Unluer

PII: S0958-9465(17)30090-2

DOI: 10.1016/j.cemconcomp.2017.07.005

Reference: CECO 2854

To appear in: *Cement and Concrete Composites*

Received Date: 25 January 2017

Revised Date: 15 June 2017

Accepted Date: 5 July 2017

Please cite this article as: N.T. Dung, C. Unluer, Influence of nucleation seeding on the performance of carbonated MgO formulations, *Cement and Concrete Composites* (2017), doi: 10.1016/j.cemconcomp.2017.07.005.

Influence of nucleation seeding on the performance of carbonated MgO formulations

N.T. Dung[a], C. Unluer[a,*]

[a] School of Civil and Environmental Engineering, Nanyang Technological University, 50 Nanyang Avenue, Singapore 639798

* Corresponding author. Tel.: +65 91964970, E-mail address: ucise@ntu.edu.sg

Abstract

The continuation of the hydration and carbonation reactions within reactive MgO cement formulations is inhibited by the formation of hydrate and carbonate phases around MgO particles, resulting in a low MgO utility and limited mechanical performance. This study introduces carbonate seeds into the pore space of MgO-based concrete mixes to enable the nucleation and growth of carbonates on the seed surfaces. The influence of seeds on the hydration and carbonation capability, mechanical performance and microstructural development was evaluated through isothermal calorimetry, water absorption and compressive strength measurements, along with TGA, XRD and SEM analyses. The introduction of ≤ 1% seed within the initial mix design increased the carbonate phase content and improved carbonation degree by up to 96% by increasing the availability of $Mg(OH)_2$ for carbonation. The dense formation of carbonates in seeded samples enabled improved microstructures and 28-day strengths of 64 MPa, which were 33% higher than unseeded samples.

Keywords: MgO; Hydration; Carbonation; Compressive strength; Microstructure