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Sadegh Ghourchian, Mateusz Wyrzykowski, Luis Baquerizo, Pietro Lura

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Susceptibility of Portland cement and blended cement concretes to plastic shrinkage cracking

Sadegh Ghourchian[1,2,*], Mateusz Wyrzykowski[1], Luis Baquerizo[3], Pietro Lura[1,2]

[1] Empa, Swiss Federal Laboratories for Materials Science and Technology, Dübendorf, Switzerland

[2] ETH Zurich, Swiss Federal Institute of Technology Zurich, Switzerland

[3] LafargeHolcim Research Centre, Saint-Quentin Fallavier, France

[*] Corresponding author: sadegh.ghourchian@empa.ch

Abstract

The market share of different types of blended cements is increasing year by year. Generally, blended cements are ground to higher fineness and exhibit a slower development of mechanical properties compared to Ordinary Portland Cement (OPC), which might affect the concrete performance in terms of shrinkage cracking at early ages.

In this paper, the performance of concretes made with different cement types are compared according to the ASTM C1579-13 standard for plastic shrinkage cracking. The cracking behavior was further correlated to the deformations of both unrestrained and restrained specimens measured by a 3D image correlation system. The main factors influencing the cracking behavior were discussed based on poromechanics. It is concluded that the bulk modulus evolution has a dominant effect on controlling the plastic shrinkage cracking. Concretes made of more reactive cements, in particular with higher clinker content, are less susceptible to plastic shrinkage cracking. For cements with the same clinker content, increasing the cement fineness reduces the risk of plastic shrinkage cracking.

Keywords: cement type, blended cement, plastic shrinkage cracking, bulk modulus, fineness, capillary pressure.