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Size effect on splitting strength of hardened cement paste: Experimental and numerical study

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1 Size effect on splitting strength of hardened cement 2 paste: experimental and numerical study

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6 **Abstract:** Cement paste possesses complex microstructural features including defects/pores over a
7 range of length-scales, from nanometres to millimetres in size. As a consequence, it exhibits different
8 behaviour under loading depending on the size. In this work, cubic specimens in a size range of 1: 400
9 were produced and tested by a one-sided splitting concept using different testing instruments. The
10 smallest specimen with size of 100 μm showed a high nominal splitting strength (18.81MPa), an order
11 of magnitude higher than the measured strength of 40 mm specimen (1.8 MPa). The test results were
12 used to fit existing analytical size effect models. Although a good fit can be found for the existing size
13 effect models, special attention should be given to the physical meaning behind these empirical
14 parameters. In addition, a multi-scale modelling strategy that considers microstructural features at
15 different length scales was adopted to model the trend of decreasing strength with specimen size
16 observed in experiments. A good agreement between experimental observations and modelling results
17 indicates that the featured material structure dominates the observed size effect on measured strength
18 in the size range considered.

19 **Keywords:** Micro-mechanical testing; Multiple length scales; Splitting tensile strength; Lattice
20 modelling; Hardened cement paste

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