Numerical Simulation of Porosity in Cements

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Abstract

The pores in cementitious materials, their sizes and connectivity have an important influence on the durability of concrete. Several microstructural models have been developed to simulate the three-dimensional pore network in cement pastes. In this article, microstructures with the μic model are compared with experimental results. It is seen that despite having a resolution for the capillary pores very close to reality, the experimentally observed breakthrough diameter from mercury intrusion is much lower than the values obtained by applying an algorithm of mercury intrusion to the simulated microstructure. The effect of some of the most important input parameters on the pore sizes in the simulated microstructure explored. The phenomenon which seems best able to explain this discrepancy is that C–S–H is not in fact a phase with a smooth surface as represented in microstructural models, but a phase which grows as needles into the pore space, leading to very small water-filled capillary pores from quite young ages. The results demonstrate it will be extremely challenging to represent the porosity of real microstructures in microstructural models.