Macro/micro-pore structure characteristics and the chloride penetration of self-compacting concrete incorporating different types of filler and mineral admixture

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The relationship between the internal pore structure features at different scales and the local micro-characteristics of the interfacial transition zone (ITZ) to the non-steady state chloride migration coefficient (Dnssm) is investigated for one normal and three types of sustainable high performance self-compacting concrete mixes. The pore structure classification at different scales and the percolation degrees of the ITZ's pores were determined using both vacuum-saturated and Mercury Intrusion Porosimetry (MIP) techniques. Further, the local micro-permeation features of the ITZ, such as thickness, porosity and the chemistry of its hydration products is examined using the SEM coupled with the EDX analysis on polished, carbon-coated, flat specimens. Chloride movement was achieved using a modified rapid migration test. It was deduced that the degree of percolation of the pores of the ITZ had a significant role in controlling the chloride penetration process. Further, it is proposed that the ITZ thickness might be, primarily, responsible in determining the chloride ions' migration velocity especially when coarse and unreactive filler are used. At nano scale, it is also suggested that the critical pore diameter in the cement matrix is more significant than is the average pore diameter in controlling the chloride resistance in SCC.