

Production, microstructure and hydration of sustainable self-compacting concrete with different types of filler

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Production, microstructure and hydration characteristics of sustainable self-compacting concrete (SCC) are investigated with two types of filler having significant differences mainly in chemical composition and physical properties. The purpose is to show how different fillers at high cement replacement levels can affect the composition, microstructural and hydration characteristics at early age. Several techniques, comprising X-ray diffraction, scanning electron microscopy (SEM) linked with energy-dispersive X-ray (EDX) analysis, image analysis, mercury intrusion porosimetry and thermo-gravimetric analysis, were used in order to demonstrate the effect of these two fillers at high replacement proportions. The two types of sustainable SCC produced had a compressive strength of 50–60 MPa and used the same water to binder ratio. The replacement rate of both limestone powder (LP) and fly ash (FA) was about 33% of the total binder (450 kg/m³). In spite of the equal water to binder ratio and approximately the same compressive strength grade at 28-days, limestone powder self-compacting concrete (LP–SCC) had a different microstructure and hydration products from the fly ash self-compacting concrete (FA–SCC). The results indicate that the fly ash was the more suitable for the production of sustainable SCC.