The Influence of Silica on the Properties of Cementitious Composites

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Abstract : Silica is used in construction materials as a part of natural raw materials or as an additive in powder form (micro and nano dimensions). SiO_2 particles in cement act as centers of nucleation, as a filler or as pozzolan material. In this regard, silica improves the microstructure of cementitious composites, increases the mechanical properties, and finally also results into improved durability of the final products. Improved properties of cementitious composites may lead to better structural efficiency, which, together with increased durability, results into increased sustainability signature of structures made with this kind of materials. The aim of the present work was to investigate the influence of silica on the properties of cement. Fly ash (as received and mechanically activated) and synthetized silica (sol-gel method using TEOS as precursor) was used in the investigation as source of silica. Four types of cement mixtures were investigated (reference cement paste, cement paste with addition of 15wt.% as-received fly ash, cement paste with 15 wt.% mechanically activated fly ash and cement paste with 14wt.% mechanically activated fly ash and 1 wt.% silica). The influence of silica on setting time and mechanical properties (2, 7 and 28 days) was followed. As a matter of fact it will be shown that cement paste with composition 85 wt. % cement, 14 wt.% mechanically activated fly ash and 1 wt. % SiO_2 obtained by the sol-gel method was the best performing one, with increased compressive and flexure strength by 9 and 10 % respectively, as compared to the reference mixture. Acknowledgements: 'COST Action CA15202, www.sarcos.eng.cam.ac.uk'

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