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Reduction Shrinkage of Concrete without Use Reinforcement

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Abstract : Concrete's volumetric changes are natural process caused by silicate minerals' hydration. These changes can lead to cracking and subsequent destruction of cementitious material's matrix. In most cases, cracks can be assessed as a negative effect of hydration, and in all cases, they lead to an acceleration of degradation processes. Preventing the formation of these cracks is, therefore, the main effort. Once of the possibility how to eliminate this natural concrete shrinkage process is by using different types of dispersed reinforcement. For this application of concrete shrinking, steel and polymer reinforcement are preferably used. Despite ordinarily used reinforcement in concrete to eliminate shrinkage it is possible to look at this specific problematic from the beginning by itself concrete mix composition. There are many secondary raw materials, which are helpful in reduction of hydration heat and also with shrinkage of concrete during curing. The new science shows the possibilities of shrinkage reduction also by the controlled formation of hydration products, which could act by itself morphology as a traditionally used dispersed reinforcement. This contribution deals with the possibility of controlled formation of mono- and tri-sulfate which are considered like degradation minerals. Mono- and tri- sulfate's controlled formation in a cementitious composite can be classified as a self-healing ability. Its crystal's growth acts directly against the shrinking tension – this reduces the risk of cracks development. Controlled formation means that these crystals start to grow in the fresh state of the material (e.g. concrete) but stop right before it could cause any damage to the hardened material. Waste materials with the suitable chemical composition are very attractive precursors because of their added value in the form of landscape pollution's reduction and, of course, low cost. In this experiment, the possibilities of using the fly ash from fluidized bed combustion as a mono- and tri-sulphate formation additive were investigated. The experiment itself was conducted on cement paste and concrete and specimens were subjected to a thorough analysis of physicomechanical properties as well as microstructure from the moment of mixing up to 180 days. In cement composites, were monitored the process of hydration and shrinkage. In a mixture with the used admixture of fluidized bed combustion fly ash, possible failures were specified by electronic microscopy and dynamic modulus of elasticity. The results of experiments show the possibility of shrinkage concrete reduction without using traditionally dispersed reinforcement.

Keywords : shrinkage, monosulphates, trisulphates, self-healing, fluidized fly ash
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