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Sucrose absorption by products of hydration of the Portland cement

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Abstract

Portland cement hydration products that are formed during its intensified hydration (grinding of cement-cement slurry) under conditions of high values of water-cement ratio and the presence of significant amounts (more than 1 % by mass) of modifying carbohydrate (sucrose) were studied. The structure and phase composition of the modified cement intensified products were determined by X-ray phase analysis and electron diffraction from the selected site. The latter are a mixture of weakly crystallized and crystalline (ettringite) phases. The elemental analysis of hydrated silicate phases revealed the identity of the control and modified samples according to the content of SiO_2 and CaO, while the content of structural water was increased by 12% in the modified sample. The sucrose content in the liquid phase of water-cement suspensions subjected to milling was evaluated. Using a spectrophotometric method using an anthron (9,10-dihydro-9-oxo-anthracene) reagent, it was found that the products of intensified cement hydration have a high ability to absorb sucrose. Over the entire range of the studied concentrations of sucrose (2.5-16.6%), the degree of its absorption by the solid phase exceeds 98%. The threshold concentration of modifying sucrose was determined, the excess of which leads to a sharp increase in the equilibrium concentration of sucrose in the liquid phase of water-cement suspensions. The study of cement hydration products modified with various amounts of sucrose by the method of differential thermal analysis in atmospheric conditions revealed a discrepancy between the increase in mass loss of the samples and the amount of sucrose added to modify the sample. For every additional 3% sucrose introduced into the composition of the water-cement slurry for the intensified hydration of cement, the increase in mass loss of samples of modified hydration products at temperatures above 200 was 1.7-2.0%. The latter suggests the formation of compounds including Saccharose – Products of cement hydration.

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