FUNCTIONAL SILICONES: IMPREGNATION OF CONCRETE, RADIATION CURING, STRUCTURE AND PROPERTIES

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ABSTRACT

It is known that around 25-30 % of the funds supporting building industry are spent on a restoration of destructions caused by corrosion. One of the ways of concrete protection against corrosion and increasing durability of building constructions is surface painting and impregnation by waterproofing materials. For this purpose the organosiloxanes are used [1, 2]. Their main drawback is high viscosity and low deepness of penetration into concrete that causes an easy erasibility of protective layers at exploitation in abrasive conditions. Last decades the radiation-chemical technologies attract serious attention due to minimal energy expenses, high speed of processes, possibility to carry out chemical reactions at ambient temperature and, importantly, absence of the residual radioactivity in the materials treated [3]. In this work the impregnation of concrete by unsaturated organosiloxane compositions of low viscosity followed by their irradiation (by accelerated electrons with the absorbed dose 25-300 kGy) induced polymerization and curing has been studied as well as structure and properties of the cured polymers and modified concrete. The investigation were carried out first on pure compositions, then on the samples of model cement stone impregnated by by silicone compositions and next on real concrete. 2 main principles of concrete modification by radiation curable silicone blends were used: (1) surface imgrenation of concrete samples by silicones followed by irradiation by electron beam with the total absorbed dose 25-100 kGy; (2) introduction of silicone modifiers into the initial mixture of the components before concrete formation followed by formation of concrete with further irradiation of the samples of concrete formed. Additionally to the abovementioned methods the combined approach was used (3) introduction of silicone modifiers into the initial mixture of the components before concrete formation followed by formation of concrete, surface imgrenation of concrete samples by silicones followed by irradiation of the concrete samples obtained by electron beam. As the componets of silicone blends the following compounds were used: vinylheptamethylcyclotetrasiloxane, octamethylcyclotetrasiloxane, diallyldimethylsilane, polymethylsiloxane oligomer (MM 1000 g/mol), oligomethylhydridesiloxane. Monitoring of the polymerization/curing processes was fulfilled by FTIR spectroscopy. Reactions of unsaturated bonds, cycles opening, grafting of polymers to the concrete surface have been observed and analyzed. Thermal behaviour and phase structure of polymers and composites synthesized was studied by DSC technique. The influence of composition and irradiation dose on thermal stability of the samples of cured polymers and composites was investigated by TGA method. Physical-mechanical properties (compression set), hydrophobisity, water absorbsion, frost and chemical resistance have been measured according the existing standards. Undoubted effect of modification on concrete basic characteristics has been fixed. The compression strength was increased by 15 %, the water absorbsion was decreased by several times, the frost and chemical resistance were significantly improved.

References

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