MODIFICATION OF POLYMER AND GLASS FIBRES FOR CONCRETE REINFORCEMENT

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The fibres currently being used in fibre-concrete can be classified into low modulus, high elongation (polyethylene, polypropylene, polyamide, etc.) and high strength, high modulus (steel, glass, asbestos, etc.) ones. The first group impart toughness and resistance to impact and explosive loading but do not give strength improvement, while the second one produce strong fibre-concrete composites and impart strength stiffness to composite.

The results of the researches performed suggest that the enhancement of fibre-reinforced concrete properties is determined not only by the technology of preparation of concrete mortar but also by the chemical nature, physical properties of fibres, and the bond between the matrix and fibres.

The present work is devoted to a surface modification of commercially available polypropylene and E-glass fibres with the aim to enhance their adhesion to cement matrices and chemical resistance to the alkaline environment formed by hydrating Portland cement paste.

The polypropylene fibres were modified by mechanical roughening using UV-treatment and by deposition of polyurethane lacquer onto the surface of the polyethylène fibres. To raise the surface energy of polypropylene fibres, the fibres were modified by treating them with an oxidizing $K_2Cr_2O_7 + H_2SO_4$ solution, too. The pullout and strength-deformation characteristics of polypropylene fibre as functions of several types of surface treatment methods were determined.

To enhance the chemical durability of E-glass fibres, single and double layer sol-gel derived TiO_2, and TiO_2-SiO_2 dip-coatings were deposited onto commercially available E-glass fibre strands desized at various temperatures. The chemical durability of coated E-glass fibre strands was determined as a weight loss (%) of the fibres after soaking in a 2N NaOH solution at 100°C during 24 h and in a 10% NaOH solution at 100°C during 1 h. The coatings and sol-gel compositions obtained were characterized by coating thickness measurements, X-ray diffraction analysis, and infrared absorption spectra.

The pullout and strength-deformation characteristics testified that, without modification of the polypropylene fibres, a reasonable adhesive strength between the fibres and cement based matrix could not be provided. The sol-gel derived TiO_2, TiO_2-SiO_2 up to 500 nm thick dip-coatings give an enhancement of chemical durability of E-glass fibres by 50%.