

# ADHESION IN THE "CARBON FIBER – NANOCOMPOSITE POLYMER MATRIX" SYSTEMS

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Adhesive interaction of the components in polymer composites dramatically determines the physical, mechanical and applied properties of materials. The quantitative estimating of the adhesion of carbon fibers to polymers is an important but rather complex experimental task, especially taking into account thinness and the fragility of fibers themselves. It is most convenient to evaluate the critical length of the fiber inside fracture zone of a common carbon sample after the tensile test. The actual length of fibers on the fracture surface corresponds to their "critical" length, which is assumed to characterize the strength of the adhesive bond with the binder. Length measurements of fibers prominent from matrix are usually carried out microscopically, which is a sophisticated but prolonged testing method.

We have proposed a new method for evaluating the adhesion-based measurement for microplastics immersed in an electrolyte solution consisting in the determination of the electrical impedance of a rupture surface. Microplastic sample consists of a complex thread or cord impregnated with a binder. During tensile test, the microplastic is destroyed, and the fibers prominent above the surface layer of the matrix provide the electrical contact with an electrolyte solution. The longer are the fibers sticking out from the matrix-insulator, the lower is the adhesion to the binder, and correspondingly lower is the electrical resistance of the surface in the sample fracture zone.

The proposed method includes the study of adhesion between carbon fibers and epoxy resin modified by various nanofillers binder.

The adhesive strength passed through a maximum along with the increase of nanoparticles content in the system. Particularly, the adhesive strength of the nanodiamond filled system increases by 2.5 times in comparison with a binder containing no nanoparticles. In modified binder, the tensile strength of carbon microplastics increased up to a certain limit. When the specific concentration of nanodiamonds achieves some level, the increase in strength up to 18 % was observed. Thus, the addition of nanoparticles in the epoxy oligomer can improve the adhesive interaction of fibers with a binder and improve the strength properties of reinforced plastics.