Effect of tin oxide nanoparticles synthesized in liquid-phase plasma discharge on the mechanical properties of dispersed reinforced composite material films

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In this work, the mechanical properties of thin films of filled ethylene-vinyl acetate copolymer and specially synthesized tin oxide nanoparticles were studied. Tin oxide nanoparticles synthesized in a plasma discharge under the treatment with ultrasonic cavitation have a size of 50–60 nm, and under ultrasonic treatment the particle size is 30–40 nm. Using these two types of nanoparticles (before and after ultrasonic treatment), samples of films made of composite materials were obtained and studied. The results of studies of fractures of films obtained at liquid nitrogen temperature using scanning electron microscopy show that the structure of the material is quite integral, there are no visible large defects or cavities. Physical and mechanical tests were carried out on a film made of a composite material with different contents of tin oxide nanoparticles: 1 and 3 wt %. Data on the values of the elastic modulus, Poisson's ratio, proportionality limit, shear modulus, yield strength, ultimate strength and ultimate deformation were obtained. The results of mechanical tests show that ultrasonic treatment of tin oxide nanoparticles before their impregnation into a polymer matrix has a positive effect on the physical and mechanical properties of films made from the studied composite material.

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