FORMATION OF POLYTETRAFLUORETHYLENE-BASED STRUCTURES WITH IMPLANTED NANOTUBES AND ITS OPTICAL SPECTRUM

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Polytetrafluorethylene (PTFE) films belong to a class of non-polar polymers which are used intensively in electronics, electroacoustics and medicine due to electret properties. In this connection, for the formation of new structures on the basis of such films it is attractive to implant nanomaterials into the matrix, which is a PTFE film up to 100 micron thickness.

In this paper a method of nanotubes implantation with use of Q-switch laser plasma acceleration of particles (see the simplified scheme on figure below) and the results of such implantation of carbon nanotubes on the optical spectrum of PTFE films which served as substrates.

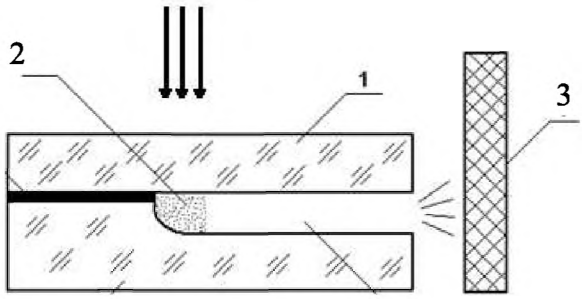

Figure 1. 1 – transparent protective screen, 2 – nanotubes, 3 – PTFE film.

Interaction of laser nanosecond pulse with nanotubes and of the nanotubes with matrix (substrate) in the process of implantation, related to the peculiarities of the proposed implantation method is considered. It is shown that transmission spectrum for structures created by nanotubes implantation into the film depends on its thickness and changes substantively for thicker films. At the same time, the transparency of structures with nanotubes of thickness which had increased by 20 micron as the result of the implantation in the optical wavelength region of 500-780 nm is higher than for thick films without nanotubes. Contrarily, in 780-850 nm region transparence of films without nanotubes is better, in accordance with Beer–Lambert–Bouguer law. On the basis of the optical spectra analysis with taking into account of electron microscopy images of surface and sides before and after the implantation of carbon nanotubes a physical model for interpretation of transparency increase for obtained structures is proposed. The model takes into account the packing of PTFE films macromolecules and their reorientation in the process of implantation, influence of distinct groups of implanted carbon atoms on transparency which is accompanied by decreasing of Fresnel losses of the formed structures.