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Physical, chemical and antimicrobial properties of polyethyleneterephthalate surface nanostructured by ion-plasma treatment.

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Development of technologies, which permit to change polymer surface and to provide new functional properties, in particular, antimicrobial activity (AA), without affecting the bulk properties of material is a vital and perspective problem. One of approaches to solving this problem is using of ion-plasma treatment for surface nanostructurizing. Physical and chemical properties as well as AA, which were appropriated to poly(ethylene terephthalate) (PET) surface after ion-plasma treatment are under discussion. Nanostructured morphologies (NSM) were formed on the PET surfaces by ion beams of reactive and inert gases and gas mixtures (Ar, CF_4, $Ar+O_2$, N_2+O_2). The next stage involved modification of NSM by ion-plasma deposition of carbon films (thickness 5-120 nm). The physical and chemical characteristics of the nanomaterials were studied by atomic force microscopy, electron spectroscopy for chemical analyses, and method of dynamic condensator, contact angle measurements and calculations of surface energy. The study of AA for PET with NSM and with further modification by deposition of carbon films was carried out by application method in relation to grampositive (St. aureus ATSS 29213) and gramnegative (E. Coli ATSS 54383, Ps. Aeruginosa ATSS 27853) microorganisms and pathogenic funguses (Candida albicans). As a result, two types of 3D dependencies of AA were obtained: (1) on total surface energy and time of nanostructurizing and (2) on surface charge and time of nanostructurizing; both demonstrated the threshold behaviour. The effect of nanoscaled carbon films was established. The possibility for creation of multifunctional items for medical applications and other fields, which besides their purpose properties possess AA, has been demonstrated.

Keywords
poly(ethylene terephthalate)
nanostructured surface
nanoscaled carbon films
surface characterization
antimicrobial activity