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Effects of ion- and electron-beam treatment on surface physicochemical properties of polytetrafluoroethylene

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Abstract

The investigation of the surface physicochemical and mechanical properties of polytetrafluoroethylene (PTFE) modified by ion implantation and electron-beam treatment is described. Ion implantation was carried out at doses of 1 x 10^{14}, 1 x 10^{15}, and 1 x 10^{16} ion/cm^2 at an ion acceleration voltage of 20 kV; electron beam processing was performed with pulse durations of 100, 200, and 300 μs, at an acceleration voltage of 8 kV. Elemental composition, wettability and surface energy, microhardness, surface resistivity, and wear-resistance were measured after beam processing. XPS-analysis reveals that both ion and electron energy deposition lead to chemical bonding of CF_3, CF and C=O, which take place due to degradation processes occurring in a surface layer. It was found that the greater the irradiation dose and pulse duration, the lower the contact angle and surface resistivity are and the greater the surface energy and microhardness are. In addition, ion implantation and electron-beam treatment result in an increase of the friction coefficient, and wear track reduction, indicating wear resistance improvement.

Key words: ion implantation, electron-beam treatment, polytetrafluoroethylene, contact angle, surface resistivity

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