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PRODUCTION OF POLYMER COATINGS OF PERHYDROPOLYSILAZANE IN COLD ATMOSPHERIC-PRESSURE PLASMA *)

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Inorganic (–SiH2–NH–) polysilazanes are among the most convenient compounds for creating heat-resistant, abrasion-resistant and corrosion-resistant silicon dioxide coatings. In the case of thermolabile substrates, it seems promising to use low-temperature plasma as an initiator of the synthesis of SiO2 layers, since it avoids thermal damage to the material.

The aim of this work is to directly prove the applicability of low-temperature atmospheric pressure plasma for the production of coatings based on perhydropolysilazane (PHPS) on organic polymer substrates (polyethylene terephthalate (PET), polymethylmethacrylate (PMMA)).

A cold plasma jet (APPJ) with a buffered plasma–forming gas argon and having the following characteristic parameters was used in the work: nominal input voltage – 20 V; input current – 30 mA; frequency of a piezoelectric converter - 19-22 kHz; maximum output voltage – 5 kV; efficiency at a load of 30 mOhm – at least 0.5. Length depending on the geometry of the reaction volume, the plasma torch ranged from 10 mm to 50 mm. The APPJ was processed within 5-10 minutes. For precise positioning of the APPJ on the sample surface, the installation was equipped with a mechanical programmable manipulator.

The interplay of active particles and UV radiation, generated both within the plasma jet and through plasma chemical reactions in the atmosphere surrounding the APPJ zone, initiated the rupture of Si-H and Si–N bonds in PHPS and its polymerization with the addition of oxygen along the formed free valences. As a result, homogeneous coatings with a thickness of ~1.2-1.7 microns were formed on the surface of PET and PMMA, the elemental composition of which contained silicon and oxygen atoms. The presence of Si–O bonds characteristic of silicon oxide (IV) was established with the help of IR NPVs. The coatings obtained had a contact angle of wetting by water $\theta W = 85.2 \pm 2.7°$, i.e. they were sufficiently hydrophobic, this property remained stable for at least two months.

In the future, it is planned to investigate the possibility of plasma chemical treatment for the functionalization and control of the characteristics of the obtained silicon-containing coatings (thickness, morphology, hydrophilic-hydrophobic properties, etc.).

*) abstracts of this report in Russian