

The hydrophilic properties of polymeric nanofilms on pretreated substrates by the atmospheric discharge plasma

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The treatment by low temperature dielectric barrier discharge plasma is one of the perspective method of substrates surfaces purification from the adsorbed gasses, water and others substances.

Composition PMMA films with silicon dioxide nanoparticles (NP) were obtained from a mixture of PMMA and SiO₂ in chlorophorm with the ratio of 1 mol PMMA : 1.7·10² mol SiO₂ by Langmuir – Blodgett (LB) and spin-coating (sc) methods. Preliminary, the substrates were treated by low temperature dielectric barrier discharge plasma. The surface of the PMMA film on the glass substrate after plasma treatment is characterized with contact angle 1.5 times less as compared to untreated substrates (Fig.).

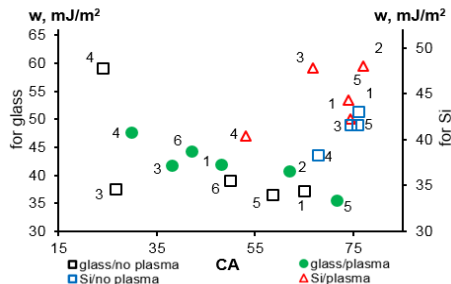


Fig. The value of contact angle and surface free energy of PMMA films with NP of SiO₂ (1 – PMMA, s-c; 2 – PMMA, LB; 3 – PMMA+SiO₂, s-c; 4 – PMMA/SiO₂, s-c; 5 – SiO₂/PMMA, s-c; 6–water treatment) on the glass and silicon substrates

It was shown by AFM method, that SiO₂ NP are structured on the surface of glass substrate after plasma treatment, while on the surface of silicon substrates such effect was not observed. The near-surface layer of glass substrates is both purified, and activated after plasma treatment. The silicon surface is only purified. This difference is due to the content of impurities in the glass; whereupon fragile bonds are breaking and the charge of the surface is changing that provides the formation of structured layers and dense and uniform films on this type of substrates.