SYNTHESIS OF POLYACRYLAMIDE GEL NANOLAYERS ON OXIDIZED SILICON SURFACE FOR USE AS SMART COATINGS WITH CONTROLLED RELEASE OF ANTISEPTICS

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"Smart" polymeric layers on surfaces are promising for various applications, including the development of antiseptic coatings, low-friction surfaces, surface preparation for single-molecule studies (e.g. PALM[1], STORM[2], etc.) including the dynamics of biomolecules and complex clusters[3], etc. To create such layers, polymer passivation is used. Poly(ethylene glycol) (PEG) is traditionally used for such kind of procedures, when the coverslip is seeded with a linear polymer brush. In this work, we introduce an alternative method of surface preparation: copolymerization of acrylamide and TMSPMA (3-(Trimethoxysilyl)propyl methacrylate, "anchor") chemically bonded to the surface. It is supposed that two types of monomers equally involved in the radical polymerization, so, as a result, a nanolayer of an entangled the polymer network (CoPAM) is attached to silica surface. CoPAM is a sufficiently hydrophilic polymer, non-sensitive to salt additives. It is frequently employed in the synthesis and research of surfactant-polymer and copolymer systems. Via variation of concentration and ratio between compounds, one can control the structure of this passivated film. Here, we used fixed component concentration and varied temperature of polymer synthesis, because the polymer chain length depends on it.
The objective of our study is the analysis of the structure, quality of the polymer film and its chemical composition. Using the method of X-ray reflectometry, scattering length density profiles of dried polymer films were obtained for a number of samples prepared at different temperatures. Also, the surface of the samples was studied to find out any anomalies with the help of atomic force microscopy (AFM). With the help of dynamic light scattering technique (DLS) we have obtained hydrodynamic radii of macromolecules in bulk, which correspond to chains attached to silicon surface. Analysis of data from XRR and DLS gave us information about the dependence of polymer brush height over polymer length (scaling). Composition of polymer brush was proved with X-ray photoelectron spectroscopy (XPS). At the next stage, we plan to investigate the swollen polymer film in water by neutron reflectometry, because presence of polymer brush may cause the alteration of XRR curve [4].
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