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Amino-rich plasma polymer films prepared by RF magnetron sputtering

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RF magnetron sputtering is well known technique for deposition of thin films from different kind of materials, among others also polymers. Most attention has been paid to sputtering of PTFE, however, new demands on deposition of coatings with bio adhesive or bio repulsive properties recently triggered off investigation of sputtering of various other polymers with aim to prepare plasma polymer films with different surface functionalities. One of the most challenging tasks for biomedical applications is to produce smooth and stable plasma polymer films in liquid with high surface concentration of primary amino groups needed.
There are two main approaches in production of amino rich coatings. The first one is based on plasma polymerization of monomers containing NH_2 groups in mild plasma conditions. These films can reach NH_2/C ratio up to 20 % but the stability in liquids is quite poor and deposition rate is usually very low. A second approach is based on treatment of surfaces by ammonia or N_2/H_2 plasma. Although this process is very fast, NH_2 /C ratio typically does not exceed several per cent.
In this contribution, we present combination of these two approaches. Fist we deposited stable plasma polymer films by means of RF magnetron sputtering of nylon 6.6 in mixture of Ar/N_2. Deposition rate was around 20 nm/min and nitrogen content in the film was up to 30%. These films were then treated in H_2/N_2 plasma in order to increase the surface concentration of primary amino groups. Concentration of primary amines was measured after derivatization with 4-(Trifluoromethyl)benzaldehyde by means of XPS. According to these measurements amine efficiency (NH_2/N) reached up to 20 % while NH_2/C ratio was around 10%. Thickness of the coatings after deposition and after washing in water or acetone was investigated using spectroscopic ellipsometry. It showed that changes in the thickness were les than 5%. Protein adsorption and possibility of nanopaterning of those films were also tested.

Keywords
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