Deposition of amino-rich coatings by RF magnetron sputtering of Nylon: In-situ characterization of the deposition process

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RF sputtering of polymeric targets is discussed as an efficient process of the fabrication of thin (bio-)functional films. This is also the case of RF sputtering of Nylon 6,6 that leads to deposition of amino-rich coatings needed in a wide range of biomedical applications. The main aim of this study is detailed characterization of this deposition process. Nylon 6,6 target is sputtered using planar RF magnetron in mixtures containing Ar, N₂ or H₂ at different pressures and applied powers. First, the processing plasma is characterized by mass spectrometry. It is found that operational conditions have strong impact on the composition of gaseous species flux on the substrate and in the case of ions also on their energy that influences both the deposition rate and the chemical composition of the films. The deposition rate of the films monitored by QCM increases with RF power and N₂ fraction in the working gas mixture and exhibits maximum for pressure of 2 Pa independently of the working gas mixture. The chemical structure of the growing films is determined in-situ by FTIR spectrometry and the elemental composition of the samples is evaluated by XPS spectrometer attached directly to the deposition chamber allowing thus characterization of the samples without their exposure to the ambient atmosphere. It is found that mainly the working gas mixture composition governs the chemical composition of the films; presence of N₂ results in coatings having high N/C ratio, whereas hydrogen increases the fraction of nitrogen presented in the form of primary amines. Moreover, in-situ measurements reveal different phases of the films growth leading to different chemical composition of the deposit depending on its thickness. Implications of these results for biomedical applications are discussed.

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