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Biofunctional coatings deposited on electroactive polymers for biomedical applications.

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Within materials for biomedical applications, specifically for prosthesis, there is increasing attention for the development of prevention mechanisms detecting early stages of problems associated with implantation, preventing future complication like rejection and avoiding physical and psychological discomfort of patients. As one of the most important information to be obtained are the dynamic mechanical loads, it seem interesting to rely on piezoelectric and piezoresistive materials in order to achieve smart implants. In particular, piezoelectric materials are interesting as they not only react to mechanical and electrical solicitations, but also can be also used as sensors and actuators. For acquiring the electrical signal of the sensor, suitable electrodes can be produced from Ti based coatings with multifunctional properties: conductivity and antibacterial characteristics through Ag inclusions. In order to promote the release of the Ag^+, it is proposed to incorporate Au clusters. In order to achieve a sensor with antimicrobial activity Ti, TiAg and TiAgAu electrodes were deposited by DC Magnetron Sputtering at room temperature on PVDF polymer based material. X-ray diffraction (XRD) as well as Wide angle x-ray scattering (WAXS) experiments were performed to monitor the crystalline structure of the polymer substrates upon thin film deposition and also to assess the crystalline structure of the coatings. Four point probe electrical measurements were performed in order to obtain the sheet resistivity of the samples. In order to examine the evidence of antibacterial activity, bacteria adhesion and biofilm formation on coatings were assessed by crystal violet staining, which quantifies total amount of biomass. The results show that the incorporation of Ag NP’s does not compromise the Ti conductivity and Au inclusions enhance the antibacterial effect of the coatings. Further, this electrode can be deposited in the electroactive polymer without degradation of the performance of the base material.

Keywords
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