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SURFACE ACTIVATION STRATEGY TO IMPROVE PET FUNCTIONALITY FOR CARDIOVASCULAR APPLICATIONS

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INTRODUCTION

In Europe alone, over 4.35 million deaths are annually attributed to cardiovascular diseases including aneurysms [1]. The requirements of an aortic prosthesis include the presence of a non-thrombogenic surface, sufficient mechanical strength and host compatibility [2-4]. At present, the most commonly applied prosthetic grafts are manufactured using poly(ethylene terephthalate) (PET) [4]. However, these grafts still present severe drawbacks including their lack of distensile properties and blood incompatibility [4]. Due to the hydrophobic nature of PET, platelets adhere on its surface, thereby generating thrombosis which can result in occlusion of the graft [2] and ultimately in prostheses failure.

MATERIALS AND METHODS

In the present work, commercially available PET foils (Goodfellow, biaxially oriented) were applied as substrates to perform surface modification. Briefly, the modification implies a two-step process in which, first, a primer layer is covalently grafted onto the substrate enabling, in a subsequent step, the attachment of a biopolymer coating (i.e. gelatin). Gelatin has been selected due to its non-toxic nature, biodegradability, low price and cell-interactive properties. The rationale behind is based on the fact that PET is lacking functional groups on its surface, disabling the possibility to graft biopolymers, hence an intermediate "coupling agent" is used.

RESULTS AND DISCUSSION

Up to now, most gelatin coatings applied on PET implied the physical adsorption of the protein on the surface resulting in the formation of an initially stable protein layer, but not durable over time. As a result, a chemical approach to couple gelatin to PET, as reported on herein, is necessary. In the present work, the effect of applying several surface modification parameters (including the coupling agent concentration, the applied solvent, the buffer type used, etc) on the conformation of the gelatin layer applied has been studied. The biopolymer conformation is of relevance as cell adhesion might be influenced by the protein conformation on the polyester substrate.

An in depth characterization of the materials developed was performed using ATR-IR spectroscopy, static contact angle measurements, atomic force microscopy and X-ray photoelectron spectroscopy. The stability of the coatings was determined via incubation in SBF at 37^{o}C. In addition, radiolabelling was applied to quantify the gelatin amount present on the PET surfaces. In order to investigate the homogeneity of the protein coating, fluorescence microscopy has been applied.

CONCLUSIONS

The main aim of the present work was to obtain a stable/durable protein coating on PET for cardiovascular applications. In addition to the surface modification strategy, an initial study on the dependence of the protein conformation on modified PET-samples was performed

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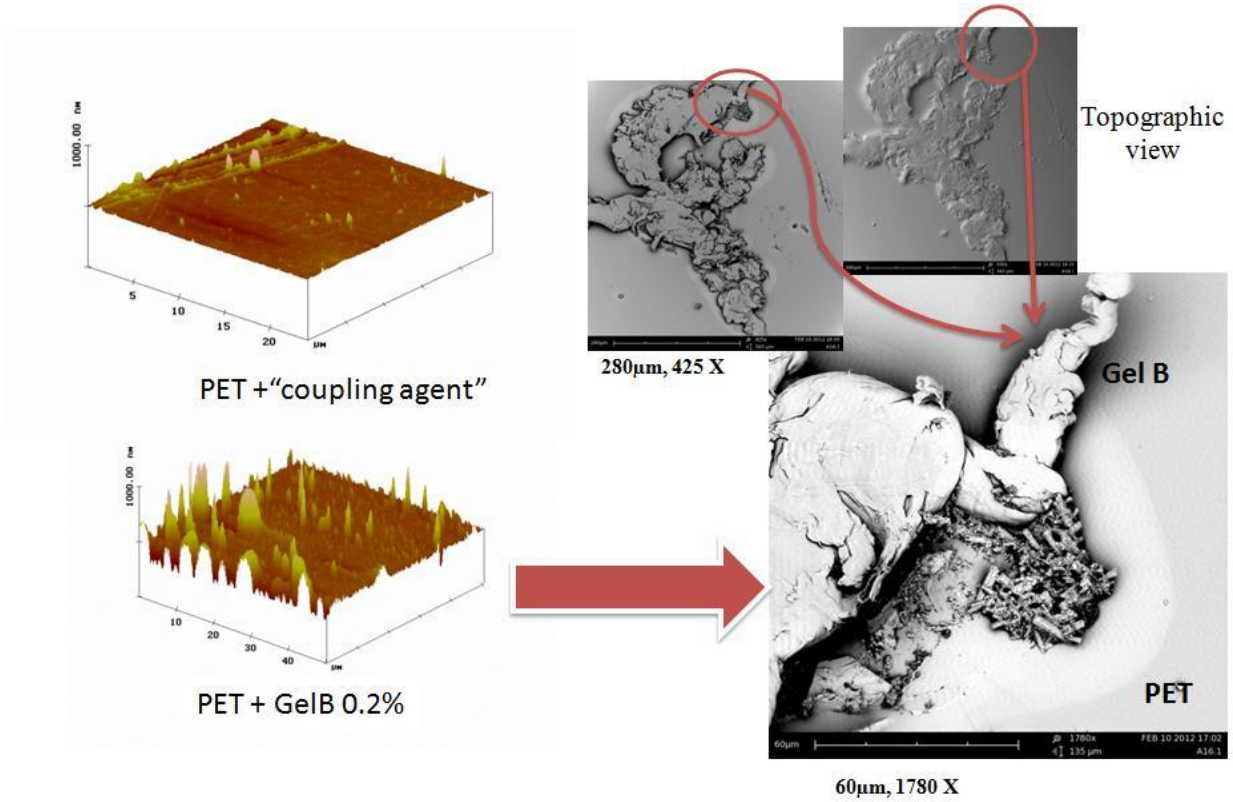

Fig. AFM and SEM images of surface-modified PET