Abstract

The polymer surfaces exhibit a high degree of chemical inertness and an additional surface modification is required to achieve the desired surface properties of the polymers without changing the satisfactory bulk properties. The surface modification leads to the combination of the appropriate bulk properties with the desired surface properties. The PET is a thermoplastic polymer, which is a condensation product of ethylene glycol and terephthalic acid or dimethyl terephthalate. By virtue of its chemical structure, PET is both hydrophobic and oleophilic. PET film is classified as an engineering film because of its excellent thermal, mechanical, optical, and electrical properties. Its main problem is that its surface is chemically inert, due to its ester nature. To use PET film in processes which involve the deposition of a film into its surface is necessary first to activate its surface with the insertion and/or creation of a new functional group (functionalization). These processes involve the deposition of inorganic thin film (for enhancement of gas barrier properties or for manufacture of integrated circuit) and/or organic thin film (for biosensor, implants) into its surface. The present thesis has as main aim the study of surface modification of PET polymer films with the use of pulsed dc plasma N_2 for biomedical uses. The thesis is constituted of three parts.

The first part (Theoretical part) is divided in six chapters. The first chapter includes the definition of biocompatibility and biomaterials, as well as the corresponding to that condition. In the next chapter is mentioned the uses of polymers as biomaterials and especially for the PET. The third chapter is a review of the present knowledge of surface modification of polymer films. This knowledge is focused in the fourth chapter in nitrogen plasma polymer surface modification. In the fifth chapter are given some basic concepts of blood composition, the coagulation system and the two main proteins of blood –albumin/fibrinogen. The sixth and ending this part chapter analyze in details the main principles and devices being used for the study of surface modification.

In the second part of the present thesis (Experimental Part and Results) is composed of five chapters. The first chapter is a description of the experimental procedure. In the second chapter is calculated theoretically the depth of surface modification with the computational program SRIM (Stopping Ranges Ion in Matter). In the same chapter are estimated the depthand the topographical changes of surface modification with Spectroscopic Ellipsometry (SE) (IR and Vis-UV) and Atomic Force Microscopy (AFM) respectively. The third chapter of this part contains the results of absorption albumin/fibrinogen study. These results are of prime importance for the evaluation of biocompatibility of modified films. Finally in the

fourth chapter, and before of that of references, the main conclusions and the proposals for future study are summarized.

In the third and last part of the present thesis the following are given in appendices: a) the exactly conditions of every experiment, b) the dielectrical function of SE IR and Vis-UV spectra of films, c) the dielectrical function of SE Vis-UV spectra of absorbed proteins, d) the total results of SRIM and finally (e) the fittings of SE spectra in the range of Vis-UV both for the determination of depth of surface modification of polymer film and (f) the thickness of absorbed protein layer.