PLASMA MODIFICATION OF POLYPROPYLENE: CONTROL OF PHYSICAL CHANGES IN THE NANOMETRIC AND MICROMETRIC SCALES.

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For real applications of polymer materials, the surfaces are of great importance since they determine the interaction with the environment. In the case of poliolefins like polypropylene, the surfaces are highly hydrofobic, being desirable for many applications an increase of the surface energy, and hence the wettability. One of the methods to achieve this goal is the exposure to a plasma, that inserts new functionalities at the polymer surface by replacing H in the C-H bonds.

However, the plasma modification is more complex, since the plasma comprises neutral molecules, ions, electrons and UV photons. These particles not only introduce surface functionalities, but also introduce odd atoms by ion implantion in the near surface region, induce cross-linking, produce changes in the cristallinity and degrade the polymer by chain scission. The different effects of the plasma exposure occur at diferent lenghts from the surface, and can be gathered as nanometric effects, occuring in the near surface region and depending mainly on the ionised particles, and micrometric effects, taking place up to several microns away from the surface and depending mainly on the UV irradiation.

In this work we have analysed polypropylene films modified by N_2 and O_2 plasmas by a combination of techniques, probing different properties and depths of the films. The plasma parameters were controlled by selecting the pressure, power and location of the samples in the different regions of the plasma column. Information on the composition depth profile was obatined by combining x-ray absorption (XANES) with x-ray fluorescence induced by electron bombardment (EDX), and ion scattering (RBS). The surface energy was determined by contact angle measurements. The surface bonding structure by combining XANES with IR-ATR. The mechanical properties at the surface by nanoindentation, and the bulk mechanical properties by Dynamic Mechanic Analysis (DMA). The structure was examined by X-ray diffraction.

A presentation of the different effects induced by the plasma is given, in connection with the different lenght scale of the corresponding modification, and their relationship with the plasma parameters. In this way, the possibility of controlling the plasma modification is discussed.

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