Plasma functionalization and bioactivity of polymers and DLC materials: the role of amine groups in the growth of cells

carmen lopez-santos¹, francisco yubero¹, jose cotrino², agustin gonzalez-elipe¹, mar fernandez³, blanca vazquez³, julio san roman³

¹ciencia de materiales de sevilla, sevilla, Spain ²universidad de sevilla, sevilla, Spain ³ciencia y tecnologia de polimeros de madrid, madrid, Spain

mclopez@icmse.csic.es

Plasma activation of polymers is a classical technology used to increase their surface reactivity by the incorporation of new functional groups. Nitrogen functional groups, specially amine groups are particularly indicated to improve cellular adhesion. In this context, we have recently proved that diamond-like carbon (DLC) coatings can be functionalized by nitrogen plasma activation in a similar way than polymers.1

In the present work we have studied the plasma surface activation of polymers like polyethylene tereftalate (PET) and low density polyethylene (LDPE) and diamond-like coatings by XPS, water contact angle measurements and atomic force microscopy (AFM). Low pressure microwave plasmas generated with a surfatron device and atmospheric pressure DBD plasmas of Ar, N₂, NH₃ and mixtures of these gases have been used for the surface activation of these materials. For comparison, the effect of a beam of neutral species has been also studied. Depending on the materials and the type of plasmas, differences have been found in the concentration and type of functional groups and in the topography and hydrophilicity of the surface of the treated materials.

Fibroblast growth studies were performed to determine the influence of the nitrogen functional groups, particularly amine groups, and the effect of the new surface properties on the bioactivity of these plasma activated materials. The role of the amine groups and that of these other surface changes on the growth of cells is critically discussed.


Keywords
bioactivity
plasma
polymer
DLC
amine