OR2008

Deposition of acrylic acid thin films by atmospheric pressure plasma jet. Potential applications for cell adhesion.

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Acrylic Acid thin films have been deposited with an atmospheric pressure plasma jet, an original and fast technique to grow organic thin films. Liquid acrylic acid was introduced directly in a nitrogen plasma jet which moved above a glass substrate to grow the thin films. Several parameters where investigated regarding the properties of the deposited material such as the speed of the jet which defines the treatment time as well as the frequency of the discharge which monitors the power injected in the plasma. The typical treatment time to grow a film of roughly 1µm thick on a large surface (dozens of cm^2) is in the order of only 30 seconds. FTIR and XPS have shown that the deposited films have typical chemical functions of acrylic acid. The retention of functional groups present in the monomer has been investigated as a function of the jet speed and frequency. As the energy input in the plasma and in the growing film increases the retention of functional groups decreases. However the retention of carboxylic groups is always high and XPS shows that around 30% of the carbon atoms can be bonded to carboxylic groups (theoretical maximum of 33%).The stability of the coatings in water has been studied by gravimetric measurements. It appears that coatings deposited with lower energy are less stable. Moreover after water rinsing, a part of the thickness of the micrometer thick films is removed, as observed by weight loss measurements without any remarkable change in the chemical composition of the films.
NIH:OVCAR-3 cancer cells were cultured in physiological conditions and were seeded in a microplate which was loaded with autoclaved coated glass cover slips for 24, 48 and 72 hours. The cell adhesion to the surface was determined by using an inverted microscope. Our results were correlated with the chemical structure of the films. The present study shows the possibilities to monitor the cell adhesion on surfaces presenting different carboxylic groups on the surface.

Keywords
Acrylic acid
Atmospheric pressure plasma jet
Biomedical application