Fibroblasts attachment on carbon nanowalls surface functionalized by reactive plasma

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The cellular and tissue responses are strongly affected by a variety of factors including the surface properties of the material (surface energy, topography, presence of specific functional groups) and the cell type. For example, the attachment and spreading of fibroblast cells are in general correlated with the hydrophilicity of the surface or with the presence of functional groups on the surface, including amine groups.
Plasma functionalization methods are well known for their ability to create functional groups on a specific surface to enable the interaction with cells. In this contribution we report on the biological response of fibroblasts to carbon nanowalls (CNWs) as-deposited or functionalized by reactive plasma. Layers of CNWs were synthesized on silicon substrates by radio-frequency plasma jet assisted chemical vapor deposition, from acetylene in presence of hydrogen [1]. After the deposition process, the surface of CNWs was functionalized by plasma generated in argon admixed with nitrogen. In addition to continuous CNWs films, patterned samples were prepared by deposition and functionalization through a metallic grid with regular openings of 700 μm arranged in hexagonal geometry. The surface of CNWs films, prior to and after plasma functionalization, was evaluated by Scanning Electron Microscopy (SEM), Fourier Transform Infrared Spectroscopy (FTIR) and contact angle measurements. These techniques indicate that plasma treatment led to a slight modification of morphology, but insertion of new functional groups, and a strong change of surface wettability from hydrophobic to superhydrofilic.
Furthermore, connective tissue fibroblasts-like cells L929 were used to evaluate *in vitro* the attachment ability on the untreated and plasma treated carbon nanowalls carpets. The number of attached cells was determined by optical imaging, while morphological changes of the fibroblasts attached were monitored using SEM. The cells viability was assessed by MTT tests, after 24 h of incubation. The results indicate that the as-grown CNWs layers inhibit the cell adhesion and induce the modification of cell morphology [2]. Contrary, on the plasma treated surfaces the promotion of adhesion and attachment of fibroblasts was obtained. Moreover, on functionalized patterned samples, a preferentially growth of fibroblasts at the border between carbon nanowalls and silicon areas was observed. These results show that carbon nanowalls may be modified specifically through the methods of plasma technology in order to improve their biological interface.

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References

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