Plasma treatments of surfaces for application in biomedicine

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Plasma enhanced physical vapor depositions are extensively used to fabricate substrates for cell cultureapplications. One peculiarity of the plasma processes is the possibility to deposit thin films with reproducible chemical and physical properties. In the present work, a plasma polymerization process was used to deposit thin carbon based films to promote cell adhesion, in the interest of testing cell proliferation as a function of the substrate chemical properties. Peculiarity of the combinatorial approach is the possibility to produce in just one deposition experiment, a set of surfaces of varying chemical moieties by changing the precursor composition. A full characterization of the chemical, physical properties was performed for each set of the synthesized surfaces. X-ray photoelectron spectroscopy was used to measure the concentration of carboxyl, hydroxyl and amine functional groups on the substrate surfaces. A perfect linear trend between polar groups' density and precursors' concentration was found. Further analyses reveled that also contact angles and the correspondent surface energies of all deposited thin films are linearly dependent on the precursor concentration. To test the influence of the surface composition on the cell adhesion and proliferation, two cancer cell lines were utilized. The cell viability was assessed after 24 h and 48 h of cell culture. Experiments show that we are able to control the cell adhesion and proliferation by properly changing the concentration and the kind of chemical moiety on the substrate surface. The results also highlight that physical and chemical factors of biomaterial surface, including surface hydrophobicity and free energy, chemical composition, and topography, can alter cell attachment.