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Biomaterials Surface and Interface Engineering by Plasma Assisted Processes

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Materials and devices used as medical implants or tools used for clinical applications, in addition to having antibacterial or bio- and hemocompatible characteristics, must also possess specific mechanical, electrical or tribological properties in order to provide useful functionalities. The interaction of biological cells with a foreign material initially takes place at their interface. The cell response is determined by chemical and morphological properties of the surface. As a result, the advanced surface engineering techniques become one of the most important means for designing high quality medical implants, devices or tools. Among various surface engineering technologies, plasma-based techniques offer the most versatile approach, since they allow surface modifications with a level of precision that approaches a monoatomic layer. Plasma techniques in general, could significantly reduce the required heat load for deposition or modification of the surfaces; therefore, allowing independent control of thermal effects. An important group of biomaterials are polymers, which have low tolerance to heat load. Pulsed plasma approach furthermore reduces the required heat load on the surface. The main advantage of pulsed plasma is that it produces significant quantities of ions, electrons and radicals, which are required for the process of deposition or surface modification, at low average energy cost. In this presentation we will give a brief highlight of the technologies that are readily available for application to surface engineering of medical and devices and tools. We will present some examples of their applications to design of antibacterial, hemocompatible and osseointegrable surfaces.

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