PVA TePla

Gas plasma precision cleaning, sterilization and surface activation of orthopedic implants promotes biocompatibility in a single, highly reproducible process step.

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Materials used for orthopedic implants are typically inert metals/alloys, ceramics and polymers. Their surface properties are engineered to encourage osteo-integration, while surface cleanliness and sterility are critical for avoiding inflammatory responses. Indeed, for implanted medical devices, achieving and maintaining surface cleanliness at the molecular level demands careful attention and exhaustive procedures.

Plasma processing is capable of removing organic contamination at the molecular level subsequent to machining, tooling and wet chemical processing steps. Plasma cleaning acts on surfaces in a conformal fashion, not only for substrates of complex geometries but also on textured surfaces with "rough" topographies. Plasma has also been shown to increase surface hydrophilicity particularly on organic based substrates.

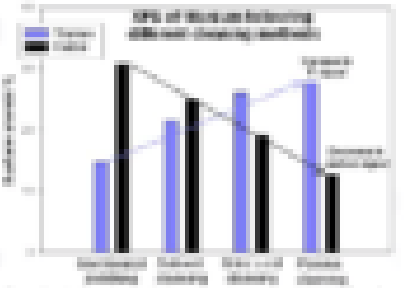
What is plasma?

Plasma is a state of matter just as a solid, liquid or gas. Add enough energy to a gas and it becomes ionized into the plasma state. Chemically it is a highly reactive environment that is used to change the properties of surfaces without affecting the bulk material.

In PVA TePla America's plasma systems, we generate plasma by using electrical energy. This excitation process produces a soup of chemically active species at ambient temperatures that can induce chemical reactions on the surfaces of materials that are not possible under normal conditions. The collective properties of these highly active species can be controlled and harnessed to perform various surface treatments such as precision cleaning, activation, chemical functionalizing, coating deposition etc. PVA TePla America's expertise is in the way we control the properties of the plasma.

Precision plasma surface cleaning

Using x-ray photoelectron spectroscopy, elemental surface atomic species were measured on titanium as a function of different cleaning methods. High signals from carbon indicate high levels of organic contamination, where as high signals from titanium indicate a clean surface.



Bar chart showing relative atomic percentages of carbon and titanium as a function of different cleaning procedures. Data taken from M. Wieland, Ph.D. Thesis, (1999) Swiss Federal Institute of Technology, Zurich

From the graph above it is clear that the highest signal from titanium, and the lowest signal from surface carbon both come from the plasma treated surface. For this reason plasma is ideally used for precision cleaning titanium and CoCr alloys after tooling and polishing implant devices. Likewise, plasma is used to clean PEEK materials after tooling and deburring. In this case plasma has a particular advantage as a cleaning technology over wet chemical methods since solvents can cause PEEK to swell thus contaminating the bulk material.