



Health, Medicine, and Biotechnology

## Atomic Oxygen Texturing and Cleaning

Atomic oxygen can improve cell attachment and eliminate endotoxins on orthopedic implants

Spacecraft surfaces in low Earth orbit are bombarded by atomic oxygen that is formed by photodissociation of diatomic oxygen in Earth's upper atmosphere. The development of ground laboratory atomic oxygen simulation facilities, to evaluate spacecraft materials and research the effects of atomic oxygen on materials, resulted in the discovery that hyperthermal atomic oxygen can produce a microscopic cone-like structure on most polymers. In addition, atomic oxygen can oxidize all hydrocarbon biological contaminants on surgical implant materials.

### BENEFITS

- Atomic oxygen surface texturing of polymeric implants provides for improved cell attachment site
- Improved tissue attachment promotes recovery, functionality and durability
- Atomic oxygen is highly effective in eliminating endotoxins and other biological contaminants from implant surfaces to reduce the potential for inflammatory responses

technology solution



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## THE TECHNOLOGY

Hyperthermal atomic oxygen causes directed oxidation of most polymers leading to the formation of left-standing cones or pillars. Such texture, whose roughness is on the order of the size of cellular pseudopods results in significant cellular attachment.

Atomic oxygen oxidizes and removes biologically active contaminants, and reduces the contaminant to an inactive ash. Thus the contaminant is both sterile and biologically inactive. The resulting surface is entirely free of any bacteria, viruses, prions, cells, or any organic matter.

Cellular adhesion to smooth surfaces is typically poor. Diagnostic decisions based on a limited number of cells can be risky. Textured surface Petri dishes and well plates can provide significant increases in attached cell populations. Cell growth on textured surfaces can allow harvesting of the medium without losing the cells that remain attached to the growth containers.

Atomic oxygen cleaning prevents endotoxin-caused inflammation from orthopedic implants because it removes the endotoxin, leaving no remaining biologically active contaminant. Currently, 3/4 of orthopedic implants have measurable amounts of endotoxins. Atomic oxygen could totally eliminate these endotoxins, thus greatly reducing chances of post-operative inflammation.



Prosthetic hip implants could have endotoxins removed by atomic oxygen.

## APPLICATIONS

The technology has several potential applications:

- Surgical implants
- Cell culturing
- Improved bonding for coatings

## PUBLICATIONS

U.S. Patent 7,305,154

U.S. Patent 7,308,164

U.S. Patent 7,382,944



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