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on Plasma Science**

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Plasma Science and Applications Committee
IEEE Nuclear and Plasma Sciences Society**

TOWER BALLROOM B

9:30 Wednesday, June 7, 2006

Chairperson: Mounir Laroussi,
Old Dominion University

Oral Session 5B: Atmospheric
Pressure Nonequilibrium Plasmas (3)

5B1-2 Invited Talk

PLASMA-TREATED BIOMATERIALS

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Surface modification utilizing atmospheric or low pressure plasma processing can effectively enhance the properties of a myriad of biomaterials. Atmospheric pressure plasma spraying has been used to fabricate relatively thick ceramic coatings for orthopedic applications such as hip joints replacement. We have recently fabricated bioactive nanostructured titanium oxide coatings that are bioactive and conducive to the growth of apatite. The materials were synthesized by nano-particle atmospheric pressure plasma spraying followed by low pressure plasma immersion ion implantation. Surface bioactivity can also be induced by irradiating the nano-structure TiO₂ coatings with ultra violet light instead of hydrogen plasma ion implantation. Low pressure plasma immersion ion implantation (PIII) has been used to treat other biomaterials to enhance the surface bioactivity. This technique offers the unique advantage that the surface properties and biocompatibility of the materials can be enhanced selectively while their favorable bulk characteristics remain unchanged. For instance, mechanically sturdy materials with good wear and corrosion resistance can be modified to improve the surface bioactivity in biomedical applications. Existing materials can thus be used and need for new classes of materials may be obviated thereby shortening the time to develop novel and better biomedical implants. For instance, biological friendly elements have been plasma implanted into diamond-like carbon (DLC) and *in vitro* analyses reveal enhanced surface biocompatibility. The effects on the biocompatibility of novel orthopedic biomaterials such as NiTi shape memory alloys will also be discussed. Last but not least, singlecrystal silicon can be made bioactive by hydrogen plasma implantation. Enhancement of the surface biocompatibility of silicon is important to the development of silicon-based biosensors.

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