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A new generation of medical devices based on Biocompatible Ultrananocrystalline (UNCD®) diamond coatings

UNCD films co-developed and patented by O. Auciello and colleagues are synthesized by novel microwave plasma chemical vapor deposition and hot filament chemical vapor deposition techniques using a novel patented Ar-rich/CH₄ chemistry that produces films with 2-5 nm grains, thus the name UNCD to distinguish them from nanocrystalline diamond films with 30-100 nm grains. The UNCD films exhibit a unique combination of outstanding mechanical, tribological, electrical, thermal, and biological properties, which already resulted in industrial components and devices currently commercialized by Advanced Diamond Technologies (company co-founded by Auciello and colleagues in 2003). This talk will focus mainly on the application of UNCD coatings for new generation of medical devices, namely:

- a) Coating for a microchip implantable in the human retina to restore vision to people blinded by retina disorders to improve biocompatibility of silicon microchips used in implantable electronic components.
- b) Coating for metallic prostheses including dental implants, hips, and knees to practically eliminate body fluids-induced corrosion and biofouling in current failing metal prostheses
- c) Coating of polymeric devices to improve antifouling properties.
- d) Development of a new generation of BioMEMS/BioNEMS devices based on UNCD to increase tribological and biological performance.
- e) Development of piezoelectric multilayer MEMS devices based on biocompatible UNCD/AlN, and UNCD/BiFeO for implantable biosensors to replace piezoactuated BioMEMS based on biologically non-compatible Lead-based piezoelectric PZT.

The biocompatible UNCD coatings are being developed for commercialization in a new generation of implantable medical devices, through a startup company (Original Biomedical Implants (OBI)) co-founded by Auciello and Gurman in 2013.

Biography

Orlando Auciello is the co-inventor of the UNCD technology. He is currently the endow chair Professor at University of Texas at Dallas. He has published more than 500 papers in world-class journals, 20 books, and holds 17 patents on the UNCD technology. Pablo Gurman received his MD from Buenos Aires School of Medicine and has been involved in R&D on micro and nanotechnology for medical applications for the last 7 years. He is the author of 20 publications, and is the editor of 2 books. He holds one patent and has 2 patent pending.

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