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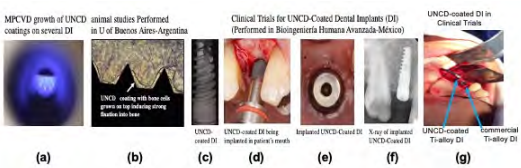
Materials science, technology development, clinical trials for transformational new generation metal dental implants coated with unique low cost / biocompatible / oral fluids corrosion resistant Ultrananocrystalline Diamond (UNCD) Coating

Titanium alloys are used in commercial dental implants (DIs). However, Ti-alloys suffer electrochemical corrosion from oral fluids, releasing TiO2 particles from the oxidized surface, causing cells' death, tissue inflammation and implant failure (15% Ti alloy-DIs fail, worldwide, in 4-5 years), requiring replacement, with patients' discomfort and extra cost.

A novel low cost ultrananocrystalline diamond (UNCDTM) coating, developed / patented by Auciello and colleagues, exhibit outstanding mechanical / biocompatible properties and full resistance to chemical attack by body fluids, previously shown for UNCDTM-coated Si microchip implanted in human eye to restore partial vison to blind by retina degeneration. This presentation describes R&D to develop UNCDTM-coated commercial Ti alloys-DIs, using an industrial Microwave Plasma Chemical Vapor Deposition (MPCVD) system enabling coating of hundreds of DIs, vertically distributed in circular pattern, in a single low-cost fabrication process. UNCD coatings are produced by flowing Ar/CH4 gas mixture in air evacuated chamber, creating a plasma producing UNCDTM film growth. A uniform plasma is produced around all implants (Fig. 1a) producing extremely uniform UNCD films, shown by Raman / SEM analysis. Chemical analysis shows that UNCDTM-coated DIs are not corroded, as Ti alloy-DIs, in artificial saliva. Histological studies of UNCD-coated Ti-alloy DIs, via in vivo animal model, showed very good biocompatibility and osseointegration (Fig. 1b), order of magnitude better than Ti alloys-DIs. Figure 1 (c) shows a UNCD-coated DI. Figures 1d /1e show UNCD-coated Ti-alloy DI inserted in human maxillary bone, and after 3 months, respectively, before crown insertion. Clinical trials (-ray in Fig 1f and implantation -Fig. 1g) conducted by Dr. López-Chávez in México demonstrated that UNCD-coated commercial Ti-6Al-4V DIs provide a new revolutionary DI technology.



Biography

Orlando Auciello degrees (honors) MS (1973) / PhD (1976) / Physics; Physics Institute "Dr. Balseiro" (Universidad Nacional de Cuyo-Argentina). EE-Universidad de Córdoba-Argentina (1970). Postdoctoral-McMaster University, Canada (1977-1979); Researcher-University of Toronto-Canada (1979-1984), Associate Professor-NCSU-USA (1984-1988), Distinguished Scientist-MCNC-USA (1988-1996), Distinguished Argonne National Lab Fellow (1996-2012)-USA. Distinguished Endowed-Chair Professor-University of Texas-Dallas (2012-present), He directs basic/applied research on multifunctional oxide [ferroelectric / high-K dielectrics], and nanocarbon (ultrananocrystalline diamond (UNCDTM) / graphene) films and applications to industrial,/ high-tech / medical devices. The UNCD film technology is commercialized for industrial products by Advanced Diamond Technologies, Auciello co-founder/2003, sold 2019), and by Original Biomedical Implants ((OBI-USA, 2013-present)/(OBI-México (2016-present)/Auciello co-founder), for new generations medical devices/ implants. Auciello edited 30 books, published 550 articles in several fields, holds 23 patents, He was associate editor of APL and Integrated Ferroelectrics, He was President of the Materials Research Society (2013) Auciello is Fellow of AAAS and MRS, and has numerous Awards.

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