The Iby and Aladar Fleischman
Faculty of Engineering
Department of Materials Science and Engineering

אוניברסיטת תל-אביב
TEL AVIV UNIVERSITY

הפקולטה להנדסה
ע"ש איבי ואלדר פליישמן
המחלקה למדע והנדסה של חומרים

Electrochemically Deposited Calcium Phosphate Coatings for Dental and Orthopedic Implants – From Fundamental Studies to the Clinics

Seminar of the Department of Materials Science and Engineering

Wednesday, November 12th , 16:00

Room 101, Engineering Class Building

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In recent years, interest has evolved in electrochemically-induced deposition of hydroxyapatite (HAp) and other calcium phosphates as an alternative to the traditional plasma-sprayed process for coating of orthopedic and dental implants. Advantages of the former include the ability to coat non-line-of-site surfaces and porous scaffolds, longer lifetime, and the potential of incorporating biological matter and drugs. Here, coatings were deposited on commercially pure Ti and Ti-6Al-4V samples by cathodic polarization. The reaction kinetics was found to be controlled by charge transfer at the interface rather than by mass transport. Two growth modes were observed: instantaneous nucleation and 2D growth, followed by progressive nucleation and 3D growth. As in the human body, HAp formed via transformation of a precursor phase (octacalcium phosphate). Corrosion tests confirm that the porous coatings did not introduce any localized corrosion issues. The effects of mechanical and chemical surface pre-treatments on the adhesion strength, surface morphology, wettability, and interactions with bone-forming cells and bacteria were also studied. Animal studies were used to quantify osseointegration and evaluate the level of cracking compared to commercial plasma sprayed coatings. The importance of coating solubility in vivo will be discussed. The coatings developed exhibit clear advantages and are currently being scaled-up in industry.

Biosketch

Prof. Noam Eliaz is the founding Head of the Department of Materials Science and Engineering and the Director of the Biomaterials and Corrosion Laboratory at Tel-Aviv University. His main research interests include environment-induced degradation of materials, failure analysis, bio-ferrography, biomaterials, and electrochemical deposition of functional materials. He is the chief editor of Corrosion Reviews. He received his B.Sc. and Ph.D. degrees in materials engineering, cum laude, from Ben-Gurion University. He was a Fulbright and Rothschild postdoctoral fellow in the H. H. Uhlig Corrosion Laboratory at M.I.T. He has published over 300 archival and conference publications and has edited Degradation of Implant Materials, Applications of Electrochemistry and Nanotechnology in Biology and Medicine I & II. Prof. Eliaz has garnered numerous awards, including the T.P. Hoar Award for the best paper published in Corrosion Science (2001), JSPS fellowship (Japan, 2005), NACE International's H. H. Uhlig Award (2010), Fellow Award (2012), and Technical Achievements Award (2014), and Northwestern University's Eshbach scholarship (2013).