Organic-inorganic nanocomposite coatings for metal implants

H. Füredi Milhofer, A. Elyada, M. Dutour Sikiric, R. Schade, K. Liefeith and N. Garti

Casali Institute of Applied Chemistry, the Hebrew University of Jerusalem, Jerusalem, Israel;
Department of Physical Chemistry, the Rudjer Boskovic Institute, Zagreb, Croatia
Department of Biomaterials, Institute for Bioprocessing and Analytical Measurement Techniques (iba) Heilbad, Heiligenstadt, Germany
*email: Helga@vms.huji.ac.il

Metal implants for bone and tooth replacement and/or repair exhibit desired mechanical properties for load bearing applications but their bioactivity needs improvement. Our approach to this problem is to modify the surfaces with biomimetic organic-inorganic nano-composite coatings. The design of the coatings is based on the observation that in some forms of biomineralization cells first deposit an organic matrix and then calcium phosphate crystals grow "in situ" upon/within this matrix [1]. The organic matrix of the coatings is deposited in the form of polyelectrolyte multilayers, PMLs, obtained by alternate adsorption of positively and negatively charged polyelectrolyte(s) [2]. Calcium phosphate crystallization is initiated either by co-adsorption of amorphous calcium phosphate (ACP) [3] or directly by functional groups of the negatively charged polyelectrolyte(s). Crystals are then grown “in situ” within the organic matrix from a calcifying solution. The type and morphology of the inorganic deposits depend on the type of the crystallization initiator (Fig.1) and on the composition of the metastable calcifying solution. The results of physicochemical characterization and in vitro biological evaluation of some of the coatings will be presented.

Fig.1. SEM micrographs of calcium phosphate crystals. A. ACP induced, B. PML induced crystallization

References

Acknowledgement: The financial support granted by the German Israeli Foundation (GIF) is gratefully acknowledged.