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Nanostructuration of biomaterials and materials by electrochemical methods

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Electrochemical methods for the preparation of high quality nanostructured surfaces and functionalization through active biomolecules electrodeposition are highlighted in this work. There are two applied electrochemical methods in our laboratory in order to obtain hybrid and nanocomposite structured layers or advanced functionalization of material surfaces. They are direct electrochemical synthesis by electro codeposition process and anodization of materials to controlled growth of nanoporous oxide films and the second method could be followed by electrodeposition of hydroxyapatite or organic compounds into porous films to form more complex hybrid layers. The main goal of the present paper is to make a summary of results obtained from applying electrochemical surface modification techniques in obtaining advanced functional surfaces and their properties characterization in terms of surface morphology and structure (SEM-EDX, XRD), the roughness and thickness, corrosion, tribocorrosion as well as the mechanical properties as nano hardness or wear resistance. Electrodeposition of metals and alloys or electro-codeposition of nano and microdispersed particles with metallic matrix to obtain micro and nano structured films and layers or hybrid coatings are a bottom-up approach of nanotechnology methods. Electrochemical oxidation or anodization to obtain thin films, layers of nano porous oxides, templates for nanowires or active biomolecules electrodeposition is a top down approach of nanotechnology method. Electrodeposition and the combination of electrodeposition with other electrochemical processes as controlled oxide growth by anodization can lead to a large class of hybrid layers and composite coatings or nanostructured layers (films) on different support materials and structures necessary for a future based on nanotechnology and nanomaterials to improve the surface functionalization of materials and to face of aggressive environments and degradation processes. Improving surface properties for corrosion and tribocorrosion of materials in specific environments give more valuable industrial and biomedical applications by increasing their life cycle.

Recent Publications

1. Valentin Marian Dumitraşcu and Lidia Benea (2017) Improving the corrosion behavior of 6061 aluminum alloy by controlled anodic formed oxide layer. Revista de Chimie. 68:77-80.
2. Lidia Benea and Eliza Danaila (2016) Nucleation and growth mechanism of Ni/TiO2 nanoparticles electro-codeposition. Journal of The Electrochemical Society 163(13):D655-D662.
3. Benea L, Başa S B, Dănăilă E, Caron N, Raquet O, Ponthiaux P and Celis J P (2015) Fretting and wear behaviors of Ni/nano-WC composite coatings in dry and wet conditions. Materials and Design 65:550–558.
4. Benea L, Dănăilă E and Ponthiaux P (2015) Effect of titania anodic formation and hydroxyapatite electrodeposition on electrochemical behaviour of Ti–6Al–4V alloy under fretting conditions for biomedical applications. Corrosion Science 91:262–271.
5. Benea L, Mardare-Danaila E and Celis J P (2014) Increasing the tribological performances of Ti–6Al–4V alloy by forming a thin nanoporous TiO2 layer and hydroxyapatite electro deposition under lubricated conditions. Tribology International 78:168–175.

Biography

Lidia Benea has completed her PhD (Doctor of Science in Chemistry) in 1996 from Dunarea de Jos University of Galati, Romania and Postdoctoral Studies from Ecole Centrale Paris - France and University Pierre et Marie Curie Paris - France. She is a University Professor, PhD Supervisor in Materials Engineering, Director of Doctoral School Fundamentals and Engineering Sciences and Director of Competences Research Center Interfaces - Tribocoorosion and Electrochemical Systems. She has published more than 300 papers in reputed journals and has been serving as an editorial board member and reviewer of reputed journals and also handled 65 externally funded project including international and national projects.

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