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Corrosion and wear performances of Co/nano-CeO2 bio-coatings in biological solution

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Metal matrix composite layers are widely used as advanced functional materials for different applications. The electrochemical deposition technique or anodization have been increasingly being established as efficient preparation route for obtaining nano and micro structured composites, cermets or hybrid coatings with specific properties to be used in industrial or biomedical applications. The process of electro-co-deposition essentially consist inclusion of solid particles suspended in an electrolytic bath into the electro crystallizing metal which is in fact the metal matrix. The particles co-deposited with a metallic matrix are generally considered insoluble. The development of modern technology requires metallic materials with better surface properties and better corrosion and wear resistance. Nanocomposites made up of highly fine particles (nanometer size) of pure metals, ceramics and polymers in a metallic matrix have been the object of investigation for some decades in science, industry and biomedical applications. Apart from the intrinsic advantages of in situ electrochemical synthesis, the route provides the opportunity of producing the coating with desired thickness and composition. Co/nano-CeO2 composite coatings were developed by electro deposition method from a cobalt plating solution containing dispersed CeO2 nanoparticles (25 nanometers size). The content of co-deposited CeO2 into nanocomposite coatings was controlled by the addition of different CeO2 particle concentrations into the electroplating solution. The corrosion and tribocorrosion performances of Co/nano-CeO2 nanocomposite coatings and pure Co coating were comparatively investigated in an electrochemical cell and unidirectional reciprocating of tribometer in lubricating conditions using simulated biological solution (Hank). During the tribocorrosion test, the normal force, tangential force, coefficient of friction, number of cycles as well as the electrochemical parameters (potential), were continuously monitored. Schematic representation of tribocorrosion tests are shown in fig. 1. The corrosion and wear performances of Co/nano-CeO2 bio-coatings are closely related with CeO2 content. The nanocomposite coating with all CeO2 content shows increased wear resistance when compared with pure Co coating.

Recent Publications

1. Lidia Benea (2012) Electrochemical impedance spectroscopy and corrosion behavior of Co/CeO2 nanocomposite coatings in simulating body fluid solution. Metallurgical and Materials Transactions A. 44A:1114-1122.

2. Lidia Benea, Pierre Ponthiaux and Francois Wenger (2011) Co-ZrO2 electrodeposited composite coatings exhibiting improved micro hardness and corrosion behavior in simulating body fluid solution. Surface and Coatings Technology 205:5379-5386.

3. V M Dumitrascu, L Benea and N Simionescu (2018) Evaluation of sealing process on the surface properties of nano porous aluminium oxide layers electrochemically growth on 1050 aluminum alloy surface. Mater. Sci. Eng. DOI: 10.1088/1757-899X/374/1/012013.

4. Lidia Benea, Laurentiu Mardare and Nicoleta Simionescu (2018) Anticorrosion performances of modified polymeric coatings on E32 naval steel in sea water. Progress in Organic Coatings 123:120-127.

Biography

Nicoleta Lucica Simionescu is a second year PhD student in Materials Science and Engineering at Dunarea de Jos, University of Galati, Romania. Her field of study is the degradation of metallic biomaterials by corrosion processes in bio-fluid environments. She received the Diploma of Second Award at the Conference of Doctoral Schools from Dunarea De Jos University of Galati, 2018.

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