TI-10MO-8NB-6ZR ALLOY WITH ECAP TECHNOLOGY FOR BIOMATERIALS: AN ANALYSIS OF TRIBOCORROSION BEHAVIOR

A.A. Santos[1]; J.V.U. Teixeira[1]; J.P.A. Carobolante[1]; A.P.R.A. Claro [1]; A.F.C. Pintão [1]; P.N. Lisboa-Filho[1]*

1. São Paulo State University "Julio de Mesquita Filho"

*paulo.lisboa@unesp.br

The most commercially used titanium alloys for dental implants and orthopedic prostheses are Ti CP4 (Pure Titanium) and Ti-6Al-4V. However, fretting corrosion of these alloys in the human body releases toxic elements that, over time, cause serious health problems. Therefore, it is necessary to investigate the tribocorrosion behavior of new developed alloys, such as Ti-10Mb-8Nb-6Zr, which can replace the commercially used alloys. There is also a concern with biomaterials, especially regard to the risk of failure. A promising way to increase the mechanical strength of titanium is nanostructuring using Equal Chanel Angular Pressing (ECAP), a Severe Plastic Deformation (SPD) to drastically reduce grain size. This work aims to investigate the tribocorrosion and titanium release in the biological environment of the four samples TiCP G4, Ti-6Al-4V, Ti-10Mb-8Nb-6Zr control and Ti-10Mb-8Nb -6Zr with ECAP alloys. The samples preparation was performed by using metallographic techniques until 1200 mesh. Tribocorrosion tests were performed on titanium alloys to investigate the effect of friction processes in the biological environment using PBS. The samples were placed at the electrochemical cell configuration using a standard two-electrode. The working electrode surface area was wrapped up in 50 mL of PBS used for each sample at the physiological temperature of 37°C. The second electrode consisted of an Ag/AgCl reference electrode. The tribocorrosion test was performed in this electrochemical cell using a rotational ball-on-plate tribometer. Firstly, we kept the sample of each alloy under PBS until reaching OCP stabilization. Secondly, when the fretting started, and we kept the sliding friction for 30 minutes to determine the coefficient of friction (COF). Finally, after the fretting stop, the passivation began until reaching the OCP stabilization for 30 minutes. After the tribocorrosion tests, the PBS were collected to investigate by UV/Visible the titanium release. The obtained results show that the Ti-10Mo-8Nb-6Zr with ECAP alloy has the highest coefficient of friction and, consequently, the most increased wear. In addition, Ti-10Mo-8Nb-6Zr ECAP samples present significant release of material in the solution.