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Repassivation of commercially pure Ti in different saliva solutions under tribocorrosion conditions

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The surface of dental implants can undergo wear during insertion and implantation into hard tissue, or, in some conditions, during its lifetime. As a consequence, the passive film presented at the implant surface can be damaged or even totally destroyed. However, if the wear action stops the surface might regenerate, giving origin to a new passive film. As all the process occurs in the presence of a chemical aggressive environment, human saliva, the material is under tribocorrosion conditions. It is also possible to introduce the concept of tribo-electrochemistry which may include two main research areas: the tribocorrosion, where the mechanical solicitations in corrosive environments are studied, and the electrochemistry of film free surfaces, where repassivation kinetics is studied after the removal of the protective oxide film on a passive metal. The main aim of this work was to study the repassivation evolution of commercially pure Ti in artificial saliva solutions.

Grade 2 commercial pure titanium samples were subjected to a small alternative sliding in a pin-on-plate tribometer against a corundum ball. At the same time, open-circuit potential (OCP) measurements were performed, before, during and after mechanical disruption of the passive film. Also, to obtain a more detailed information on the characteristics of the original and reformed passive film, EIS measurements were done before and after the mechanical damage. All the test were performed in different kinds of artificial saliva solutions (artificial saliva (AS), AS + citric acid, AS + anodic, cathodic or organic inhibitor). Additionally, the effect of pH and electrolyte composition on the repassivation evolution was also investigated. Finally, all samples were characterized using SEM, EDS, and AFM. Surface roughness was also evaluated.

Results show that, in some solutions, the open circuit potential, after repassivation, is more noble than that measured before sliding. Also, the repassivation evolution appears to be strongly affected by the electrolyte nature. The AS + citric acid is the solution that provides a better repassivation evolution with the time, however the stability of the passive film takes some time to be acquired. Also, this solution does not provide a very thick film.

Keywords : Tribocorrosion, Dental Implants, Repassivation.