

CORROSION BEHAVIOR OF TWO NEW CO-CR DENTAL ALLOYS FOR PORCELAIN-FUSED-TO-METAL CROWNS

C.M. García-Falcón¹, T. Gil-López, P.P. Socorro-Perdomo, N. R. Florido Suarez¹, Julia C. Mirza Rosca¹

¹Mechanical Engineering Department, University of Las Palmas de Gran Canaria

²Madrid Polytechnic University, Spain

EQUIPMENT

Metallographic grinder



Metallographic microscope



Precision linear saw



Oven



Analytical balance



Scanning electron microscope



Filling machine



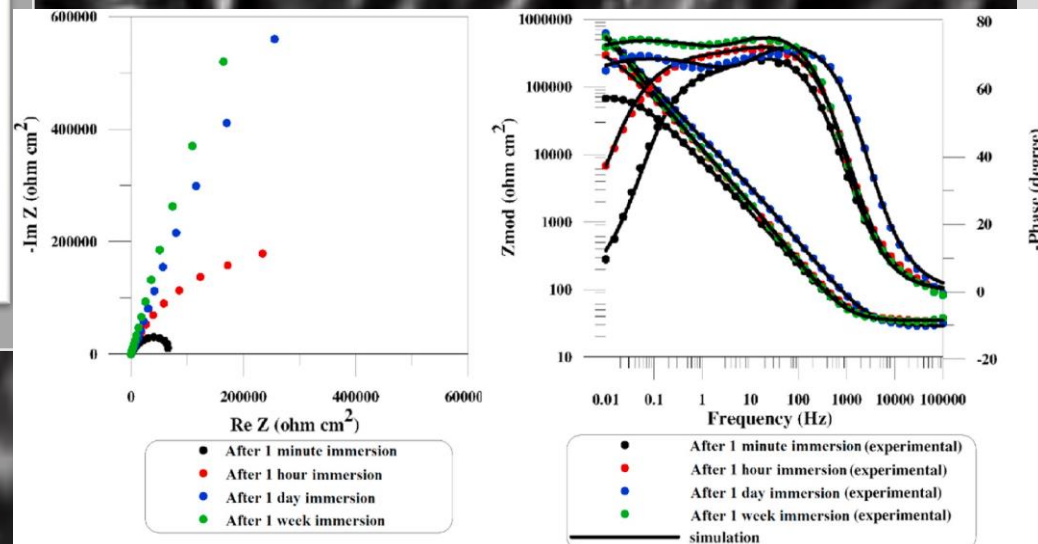
ABSTRACT

The behavior of two High Entropy Alloys of different composition, in simulated body fluid, is studied in order to determine whether these alloys are suitable for use in the field of medical prosthesis and implants. The studied materials, have the following composition:

A) 20.45%Mo, 32.45%Ta, 12.67%Ti, 18.97%Zr and 15.46%Fe;

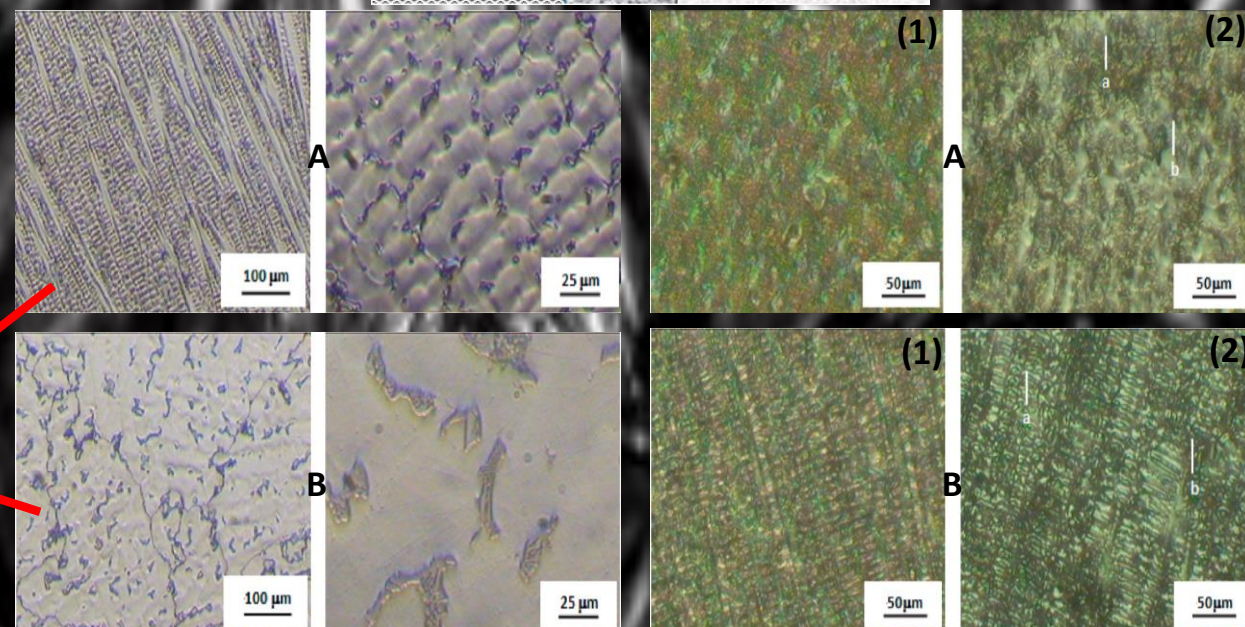
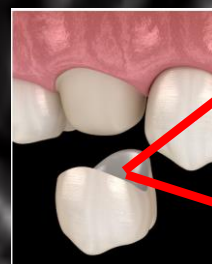
B) 17.32%Mo, 38.95%Ta, 13.21%Ti, 17.45%Zr and 13.07%Nb.

In order to characterize the properties of these two alloys, different electrochemical methods were used. First of them was Electrochemical Impedance Spectroscopy and the analysis of the spectra was carried out by fitting different equivalent circuits to the experimental data. The spectroscopy impedance results were correlated with the microstructure which was characterized by Optical Microscopy, Scanning Electron Microscopy and Energy-dispersive X-ray Spectroscopy. The surface film is non-cytotoxic because it consists of oxides of high biocompatible elements as Nb, Ta and Ti and all the results demonstrated the potential of the analyzed alloys for biomedical applications.



CONCLUSIONS

- Both alloys tend to spontaneously passivate, and this passivation tendency is very high. The alloys presented the formation of mixed protective layers $\text{Cr}_2\text{O}_3 \cdot \text{CoO}$ with high stability on their surfaces, which substantially improves their biocompatibility in Ringer solution.
- After electrochemical treatment, the alloys exhibited a uniform or general corrosion behavior, homogeneous on the surface, for areas a and b. However, due to the content of Fe and Ni, a higher degree of corrosion was found in the Vera PDI alloy. Furthermore, the kinetic parameters of the corrosion process in the experiment indicated a two-time constants process with an anodic control, attributable to the formation of passive films on their surfaces.



Metallography analysis: (A)- Vitallium 2000 Plus alloy, (B)- Vera PDI alloy

Microstructures (1) after electrochemical treatment, (2) after removal of the sediment: (A)- Vera PDI alloy, (B)- Vitallium 2000 Plus alloy.