EFFECT OF ZIRCONIUM ON CORROSION BEHAVIOR OF NEW Ti10Mo8NbXZr (X = 4, 5, AND 6) ALLOYS

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SUMMARY

Corrosion resistance is an important property for materials intended for biomedical applications. Material degradation can significantly influence biocompatibility and mechanical properties, reducing device life. Thus, the electrochemical behavior of the new Ti10Mo8NbXZr (X = 4, 5, and 6) alloys was evaluated by measurements of open circuit potential (OCP) and potentiodynamic polarization in a fluorinated physiological medium (0.15 M NaCl + 0.03 M NaF, pH = 6.0) at 37°C. During the OCP, the potential stabilized soon after the immersion, showing a small drop compared to the beginning of the analysis, possibly the effect of the dissolution of surface oxides by fluoride ions, causing a decrease in the thickness of the initial protective layer [1]. The open-circuit potential for the three studied alloys does not present a significant difference. The behavior is similar because the fraction and distribution of possible oxides formed on the surface are similar too. The results obtained by potentiodynamic polarization were also similar for the Ti10Mo8NbXZr alloys (X = 4, 5, and 6). In the cathode region, the current density rapidly decreased until it reached the corrosion potential. In the anodic part, current density increased again, indicating the oxidation of the material. Regions with lower current density growth rates were also noted, representing a more protective behavior of the material, in addition to stable regions, indicating the formation of the passive layer. The three compositions evaluated presented oscillations that indicate the occurrence of pits and repassivation. The Ti10Mo8Nb5Zr alloy had a lower current density and a larger passivation region compared to the Ti10Mo8Nb4Zr alloy. However, the oscillations were more intense. The Ti10Mo8Nb6Zr alloy showed an increased current density, but the passive region was more stable than the other alloys. When comparing the results obtained for the alloys understudy with CP Ti, Ti10Mo, and Ti10Mo8Nb, there is an

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apparent decrease in the corrosion current density and the passive layer region. Therefore, there is an improvement in corrosion resistance with the addition of zirconium. Despite not showing the best punctual values, the Ti10Mo8Nb6Zr alloy presented a more stable behavior. Thus, it is possible to conclude that zirconium acts by increasing its corrosion resistance, contributing to the potential application of Ti10Mo8NbXZr alloys (X = 4, 5, and 6) in the biomedical field.

REFERENCES

[1] de Assis, S. L., Wolynec, S., & Costa, I. (2006). Corrosion characterization of titanium alloys by electrochemical techniques. *Electrochimica Acta*, *51*(8-9), 1815-1819.