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Abstract

Corrosion behaviour of biomedical titanium alloys in simulated physiological solution

Titanium alloys are mainly used as medical implants, owing to their good strength properties as well as their corrosion resistance. They are known for their wide application in orthopedic as endoprothesis include: artificial hip joints, knee replacements, bone plates, screws fracture fixation, artificial hearts and stomatology as dental implants.

Titanium alloys with aluminium and vanadium (Ti-6Al-4V) is very popular and widely used in industrial applications, including medical devices. Therefore, passivity and corrosion resistance of this alloy have been extensively studied. By contrast, the presence in excess of some toxic element (e.g. aluminium and vanadium) in the body fluids can generate allergic reactions and genetic changes. In the light of these observations, further investigation of titanium alloys is increasingly important for gaining a better understanding of the traditionally used alloys, and for helping in the search for new titanium alloys. Recently, a number of studies have focused on the development of beta-type Ti alloys with non-toxic elements such as Mo, Zr, Sn, Ta and Nb. This is the case of titanium alloy Ti-10Mo-4Zr.

Titanium and its alloys have a good corrosion resistance. Each alloy element determines the different properties of the titanium alloy, including corrosion resistance. The passive layer of titanium alloys is exposed to the body fluids of the human body. In addition, it can be damaged by external forces (plastic deformation) and friction.

The aim of this study was to compare corrosion behaviour of two titanium alloys: new biomedical alloy Ti-10Mo-4Zr and commercial alloy Ti-6Al-4V in physiological simulated solutions. Furthermore, the influence of plastic deformation and tribological properties on the corrosion resistance were investigated. This thesis presents the scope of electrochemical studies supplemented by imaging and spectroscopic studies of passive layer.