Influence of microstructure on corrosion and biocompatible properties of Ti6Al4V alloy

Mirjam Bajt Leban[1], Tadeja Kosec[1], and Matjaž Finšgar[2]

[1]*Slovenian National Building and Civil Engineering Institute, Dimičeva 12, 1000 Ljubljana, Slovenia*

[2]*University of Maribor, Faculty of Chemistry and Chemical Engineering, 2000 Maribor, Slovenia*

Ti6Al4V alloy is widely used in different industries because of its beneficial mechanical and corrosion properties. In terms of biocompatibility, Ti6Al4V has demonstrated favorable characteristics for biomedical applications.

Ti6Al4V typically consists of the primary α-phase and the secondary β-phase. The microstructure of Ti6Al4V can be influenced by various factors, including alloy composition, heat treatment parameters, cooling rates, and processing methods. Since the chemical composition of α- and β-phase could differ significantly, this is critical for oxide film formation and its corrosion resistance.

The present research was focused on the investigation of corrosion resistance of Ti6Al4V alloy consisting of α- and β-phase, produced by three different technologies: by selective laser melting and additional heat treatment, by investment casting, and by forging. Electrochemical methods in artificial saliva were conducted in order to study the differences in their corrosion properties. Surface characterization methods, such as SEM/EDS and ToF-SIMS, were applied in addition to metallographic observation to study the correlation between the microstructure and spatial distribution of different species in the formed oxide film.

It was found that corrosion resistance depends on various microstructural factors: quantity, size, location, and shape of β-phase relative to α-phase.