Bioactive glass S520 laser cladding on ultrafine-grained pure titanium substrates

Szymon Bajda[1], Yijun Liu[3], Michal Krzyzanowski[2, 1] and Stanisław Dymek[1]

[1] AGH University of Science and Technology, Poland
[2] Birmingham City University, UK
[3] Manufacturing Technology Centre, UK
sbajda@agh.edu.pl

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INTRODUCTION

Nowadays, titanium alloys are commonly used for different biomedical applications instead of pure titanium because of their superior mechanical properties. Presence of some alloying elements, such as aluminium and vanadium, can be harmful to human health, and can be considered as disadvantage in long term applications. Potentially, there is a possibility of replacing the commercial titanium alloys with ultrafine-grained commercially pure Ti (cpTi). The yield and ultimate strength of cpTi can exceed 1000 MPa [1]. When manufacturing medical devices, laser cladding is known as one of the most promising methods for manufacturing of modern medical implants with improved osseointegration, where bioactive glass coatings are imposed on metallic substrates [2, 3].

EXPERIMENTAL METHODS

In this work, S520 bioactive glass has been imposed on ultrafine-grained cpTi using laser cladding technique. Cross-sectional SEM images of titanium substrate and bioactive glass were analyzed. The interface between bioactive glass and metallic titanium substrate was also studied using SEM/EDX.

RESULTS AND DISCUSSION

The refined microstructure of cpTi was locally modified in the areas affected by the laser beam. Figure 1 shows the cross-section of the ultrafine-grained cpTi substrate after the laser cladding process.

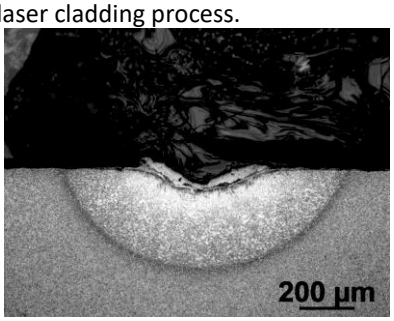

Fig. 1 Optical image showing cross-section of the ultrafine-grained cpTi.

The cross-section of the cladded bioactive glass is presented in figure 2. Some pores of up to 200 µm diameter were found within.

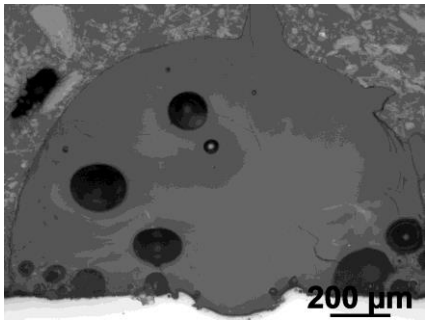

Fig. 2 Optical image showing cross-section of the S520 bioactive glass coating on the ultrafine-grained cpTi substrate.

CONCLUSION

The S520 bioactive glass was successfully cladded onto the ultrafine-grained cpTi substrate. The application of cpTi allows for exclusion of potential toxic elements from the human body and its refined microstructure allows to achieve strength properties similar to those of Ti6Al4V alloy.

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