

Influence of Substrate Temperature on Adhesion Strength of TiN Coating of Biomedical Ti–13Zr–13Nb Alloy

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Abstract Adhesion strength between the coating and the substrate is considered as a significant factor, which may help determine both the successful implantation and the long-term stability of any coated implant. A weakly adhered coating on a medical implant may delaminate after the process of implantation, which in turn may severely limit the effectiveness along with the life of the implant itself. Related previous studies have shown that process parameters may have a direct influence on the quality of TiN coating. In the present work, the effect of substrate temperature on adhesion strength of TiN coating on Ti–13Zr–13Nb biomedical grade alloy was investigated. The coating parameter, which varied in this study, was the substrate temperature (i.e., 100, 200 and 300 °C). The adhesion strength of TiN coating was examined by means of scratch testing method. In addition, calibrated optical images were also used to verify the total coating failures on the scratched coated samples. Results indicated that an increase observed in the substrate temperature may have resulted in a decrease in the microdroplet form on TiN coating. In contrast, the adhesion strength of TiN coating was observed to equally increase when substrate temperature increased. It is believed that the higher mobility of atom at a higher substrate temperature (i.e., 300 °C) filling

up the defect appears on the surface to provide a mechanical interlock and thus providing better adhesion strength.

Keywords Biomaterial · Ti–13Zr–13Nb · Adhesion strength · Sustainable · TiN and CAPVD

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