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In-situ formation of laser Ti6Al4V–TiB composite coatings on Ti6Al4V alloy for biomedical application

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Abstract

Ti6Al4V alloy has been widely used for medical implants due to good mechanical properties. For permanent implant applications Ti6Al4V alloy has shown to have low corrosion and wear resistance. Based on these the development of in-situ Ti6Al4V–TiB wall through laser metal deposition was investigated for possible use in biomedical application. The effect of laser layers and weight percentage TiB2 was in this work. The percentage of TiB2 was varying from 5 to 20. The laser wall of 10 and 20 layers was developed. The characterization of the laser alloyed surfaces was conducted using standard method. The electrochemical test was studying using Hank's solution. The deposited walls had little or no cracks and pores, as well as acceptable dilution of the substrate. An increase in the corrosion and wear resistance was achieved with an increase in TiB2. It was proved that the success of the properties achieved did not depend on the number of the layers deposited. The optimum hardness values were obtained at 20 and 15 wt.% TiB2 for 10 and 20 layers of coatings. The optimum improvement in micro-hardness resulted to about 33% increase in hardness values compared to the substrate. The presence of TiB in the laser composition and laser layer plays a significant role in increasing the hardness values, wear resistance and corrosion resistance of the substrate. It has been established that laser deposition of TiB on Ti6Al4V can be used in improving the surface hardness values, wear resistance and corrosion resistance which can be use in biomedical application.