ENHANCEMENT OF WEAR AND CORROSION RESISTANCE OF 3D-PRINTED TITANIUM ALLOYS BY GAS NITRIDING

Dr Serhii Lavrys

The present study explores the potential of gas nitriding as a method to enhance the wear and corrosion resistance of 3D-printed titanium alloys for improving the durability and performance of these materials in various applications.

3D-printed titanium alloy (Ti6Al4V) via the selective laser melting method, was selected for this purpose. Gas nitriding was carried out at temperatures ranging 650...800°C for 10 hours under atmospheric pressure. Various tests were carried out to evaluate the corrosion resistance, including electrochemical and immersion tests in a hydrochloric acid solution. Tribological characteristics were evaluated under dry sliding conditions against a ceramic ball with different loads.

It has been shown that a hardened surface layer is formed when nitrogen interacts with a titanium alloy during gas nitriding. This layer consists of an upper compound layer of TiN and Ti_2N, and an underlying diffusion zone. As the treatment temperature increases, both the surface microhardness and the depth of the hardened nitride layer increase, reaching values of ~13 GPa and 70 μm, respectively. And finally, such hardened nitride layers allow for several times improvement in the corrosion and wear resistance of 3D-printed titanium alloy.