

Characterization of N+C, Ti+N and Ti+C Ion Implantation into Ti6Al4V Alloy

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Abstract : TiN and TiC films have been prepared on Ti6Al4V alloy substrates by plasma-based ion implantation. The effect of N+C and Ti+N hybrid ion implantation at 50 kV, and Ti+C hybrid ion implantation at 20 kV, 35 kV and 50 kV extraction voltages on mechanical properties at a dose of 2×10^{17} ions / cm^2 was studied. The chemical states and microstructures of the implanted samples were investigated using X-ray photoelectron (XPS), and X-ray diffraction (XRD), together with the mechanical and tribological properties of the samples were characterized using nano-indentation and ball-on-disk tribometer. It was found that the modified layer by Ti+C implanted at 50 kV was composed of mainly TiC and Ti-O bond and the layer of Ti+N implanted at 50 kV was observed to be TiN and Ti-O bond. Hardness tests have shown that the hardness values for N+C, Ti+N, and Ti+C hybrid ion implantation samples were much higher than the un-implanted ones. The results of wear tests showed that both Ti+C and Ti+N ion implanted samples had much better wear resistance compared un-implanted sample. The wear rate of Ti+C implanted at 50 kV sample was $6.7 \times 10^{-5} \text{mm}^3 / \text{N.m}$, which was decreased over one order than unimplanted samples.

Keywords : plasma ion implantation, x-ray photoelectron (XPS), hardness, wear

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