ENHANCING THE TRIBOLOGICAL PROPERTIES OF TI6AL4V ALLOY THROUGH DUPLEX PLASMA NITRIDING AND MOS_2 COATIN

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ABSTRACT

In this study, an innovative dual surface treatment combining plasma nitriding with MoS_2 coating is introduced to enhance the tribological properties of Ti6Al4V alloy, a material widely used in aerospace, medical and marine fields. The combined of increasing surface hardness through plasma nitriding and reducing friction through MoS_2 coating represents a comprehensive solution to the inherent of Ti6Al4V alloys, such as high friction and wear [1]. Meanwhile, the influence of the surface roughness and hardness of nitride substrate on the tribological properties are also investigated, aiming to extend the service life of the MoS_2 coating [2]. The results demonstrate that a relatively rough subsurface helps retain lubricant and creates a strong and durable tribofilm, which is critical for extended performance. Although increasing hardness is beneficial to the anti-wear and load-bearing capacity of the Ti6Al4V alloy, an excessively hard subsurface cannot prolong the lifetime of MoS_2 coating. The sample with an appropriate subsurface hardness exhibits the better lifetime of the MoS_2 coatings. It highlights the importance of a synergistic approach in surface engineering, especially for materials such as Ti6Al4V alloy, where each aspect plays a key role in the overall tribological behavior. Effective control of these factors can greatly improve the durability and efficiency of such alloys in harsh operating environments. In conclusion, the research suggests that duplex plasma nitriding and MoS_2 coating treatment method offers an effective strategy for improving the performance of Ti6Al4V alloys, and optimizing the surface texture and mechanical properties of nitride Ti6Al4V can significantly enhancing the service life of coatings. By solving the critical issues of alloy surface hardness, texture and lubrication, this approach marks a significant advance in applications where improving durability and reducing wear are critical.

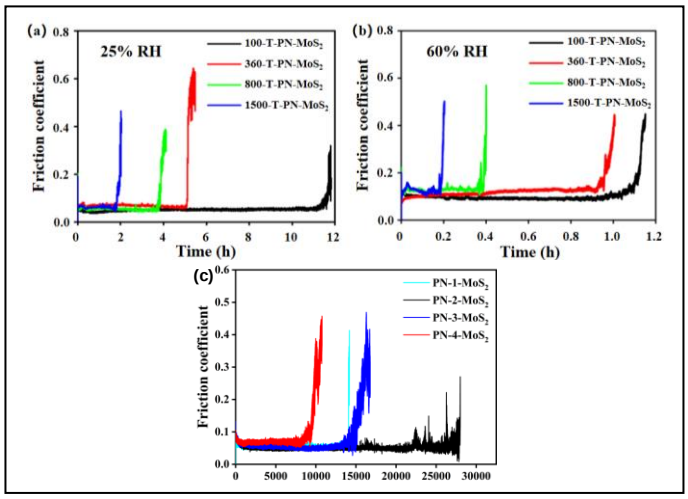

Fig.1 The friction coefficient curves of 100-T-PN-MoS_2, 360-T-PN-MoS_2, 800-T-PN-MoS_2 and 1500-T-PN-MoS_2 under (a) 25 % RH and (b) 60 % RH conditions. In which, the 100, 360, 800, and 1500 indicate that the Ti6Al4V alloys were polished with corresponding grades sandpaper before plasma nitriding. (c) Friction coefficient curves of MoS_2 coated nitrided Ti6Al4V alloy with different hardness. In which, the hardness of PN-1 to the PN-4 sample were 503, 662, 833, and 911 $HV_{0.025}$.

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