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钛合金表面离子束增强沉积MoS_2基膜层及其性能

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摘 要： 将离子束增强沉积（IBED）技术与离子束溅射沉积技术相结合，在钛合金表面制备了MoS_2， MoS_2-Ti复合膜。研究了膜层的形态、结构、膜基结合强度、硬度、摩擦学性能及抗微动（fretting）损伤性能。结果表明：所获膜层较纯溅射膜结合强度高、致密性好，复合膜中允许的金属元素含量大。通过恰当地控制复合膜中Ti的含量，可获得以（002）基面择优取向的MoS_2-Ti复合膜，该膜层有较好的减摩和抗磨综合性能，能够显著地改善钛合金的常规磨损、微动磨损（FW）和微动疲劳（FF）性能，特别是在磨损严重的大位移整体滑移条件下，MoS_2-Ti复合膜对钛合金FF抗力的提高作用可大于喷丸形变强化处理。

关键字： 钛合金；离子束增强沉积；MoS_2复合膜；摩擦磨损；微动疲劳；喷丸强化

MoS_2 composite films on Ti alloy prepared by ion-beam-enhanced deposition

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Abstract: MoS_2 and MoS_2-Ti composite films were produced on Ti alloy substrate by ion-beam-enhanced deposition (IBED) technique combined with ion-beam sputtering (IBS) method. The morphology, microstructure, bonding strength, hardness and constituent distribution of the films were studied. The wear resistance and the fretting damage behavior of

Ti6Al4V alloy coated with the films were evaluated. It is found that the films become denser and harder and with higher bonding strength compared with sputtered films. The concentration of Ti dopant permitted in the films prepared by the present method is higher than that of sputtered films. As Ti dopant concentration is proper, the new method can produce basal orientation films with excellent tribological behavior. The optimized MoS_2-Ti composite films can improve the resistance of wear and fretting damage (fretting wear and fretting fatigue) of Ti alloy significantly. Under the gross slip conditions with severe wear, the effect of the optimized MoS_2-Ti composite film is even better than that of shot peening in improving fretting fatigue performance of Ti alloy.

Key words: titanium alloy; ion-beam-enhanced deposition; MoS_2 composite film; friction and wear; fretting fatigue; shot peening