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镁基表面微弧氧化/类金刚石膜的性能表征

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摘要: 利用MgO多孔膜结构取代传统制备DLC膜所需的金属过渡层(如Ti),采用离子束复合磁控溅射技术制备出了DLC/MAO/AZ80膜基系统,并通过与MAO/AZ80, DLC/Ti/MAO/AZ80及DLC/Ti/AZ80对比,系统研究了此类膜基系统的表面微观形貌、粗糙度、纳米压痕行为、摩擦学特性及电化学性能. 结果表明: MgO多孔膜表面沉积DLC膜使其粗糙度减小, 硬度增加, 而弹性模量与MgO多孔膜相差较小;借助表层微孔特征及DLC膜的润滑特性, 使得DLC/MAO/AZ80膜基系统的平均摩擦系数与磨痕宽度与传统的DLC/Ti/AZ80膜基系统相当,并进一步制备出了具有最小的平均摩擦系数和磨痕宽度的DLC/Ti/MAO/AZ80膜基系统;由于MgO多孔膜结构的极化阻力使得MAO/AZ80, DLC/MAO/AZ80和DLC/Ti/MAO/AZ80膜基系统的耐蚀性均明显优于DLC/Ti/AZ80.

关键词: 类金刚石膜 MgO 多孔结构 性能

CHARACTERIZATIONS OF DLC/MAO COMPOSITE COATINGS ON AZ80 MAGNESIUM ALLOY

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Abstract: Diamond-like carbon (DLC) coating has been widely used to modify the surface mechanical and tribological properties of materials. In most cases, a metallic buffer (e.g., Ti) is used as an interlayer between DLC coating and the substrate to improve the adhesion. In this work, the DLC coating was deposited on the AZ80 Mn alloy substrate using ion beam deposition technique. Specially, a pretreatment of microarc oxidation (MAO) was applied to the Mg alloy substrates to form the DLC/MAO composite coating instead of the metallic interlayer process. As a comparison, the DLC/Ti/MAO and DLC/Ti composite coatings were also deposited on the substrates. The surface morphology and roughness, mechanical, tribological and corrosion properties of the as-deposited coatings were studied. The results indicated that the DLC/MAO composite coating could significantly improved the hardness and wear resistance of the Mg alloy substrates compared with the MAO monolayer. Although the surface roughness of the DLC/MAO coating showed an increase due to the micropores of the MAO coating surface, the friction coefficient and the wear tracks exhibited a similar behavior to that of the DLC/Ti coating. Furthermore, the DLC/Ti/MAO/AZ80 system showed the best tribological properties among the current experimental samples. Meanwhile, the polarization curve revealed that the corrosion resistance of the MAO/AZ80, DLC/MAO/AZ80 and DLC/Ti/MAO/AZ80 film-substrate systems was greatly improved due to the existence of the MgO structure, which processed the high polarization resistance.

Keywords: diamond-like carbon MgO porous structure property

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