

研究论文

纳米晶体钛基掺钽TiO₂薄膜的摩擦磨损性能

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摘要: 采用室温直流反应磁控溅射技术在纳米晶体钛表面制备掺钽TiO₂薄膜, 研究了掺Ta量对纳米晶体钛基TiO₂薄膜摩擦磨损性能的影响。结果表明: 在室温模拟人体体液条件下, 掺钽TiO₂薄膜与不锈钢淬火钢球(Φ4 mm)对磨的磨损率为 10^{-6} -- 10^{-5} mm³·m⁻¹·N⁻¹级; 随着Ta含量的增加, 薄膜的摩擦系数和磨损率呈先减小后增加的趋势, 掺Ta量(质量分数)为22%Ta的TiO₂薄膜具有最低的摩擦系数(0.20)和磨损率(1.5×10^{-6} mm³·m⁻¹·N⁻¹)。具有良好的抗磨性能与其硬度与弹性模量比高、抗腐蚀性强和摩擦系数低一致。

关键词: 材料表面与界面 掺钽TiO₂薄膜 磁控溅射 纳米晶体钛 摩擦磨损

Friction/Wear Properties of Ta - Doped TiO₂ Films on Surface of Nano - Grained Ti

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Abstract: The friction/wear properties of TiO₂ films with different Ta-doped content deposited on surface of nano-grained Ti by DC reactive magnetron sputtering technology at room temperature were investigated. The results show that the Ta-doped TiO₂ films exhibit the specific wear rate on the order of 10^{-6} -- 10^{-5} mm³·m⁻¹·N⁻¹ sliding against a stainless steel quenched ball (2 mm in radius) at room temperature by simulation body fluid. With the increasing Ta content in TiO₂ films, the friction coefficient and wear rate of TiO₂ films were gradually decreased and then increased. And the TiO₂ film with about 22% Ta - doped has the smallest friction coefficient (0.20) and wear rate (1.5×10^{-6} mm³·m⁻¹·N⁻¹). The good wear-resistance of the TiO₂ films with about 22% Ta - doped is in accordance with its high hardness-to-modulus ratio, good corrosion-resistance and low friction coefficient.

Keywords: surface and interface in the materials Ta - doped TiO₂ films magnetron sputtering nano-grained Ti friction and wear

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