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论文

铜基复合材料干湿条件下的摩擦学行为

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摘要：

采用粉末冶金技术制备铜基复合材料，在制动压力0. 5～1. 2 MPa 范围内，通过定速摩擦试验机研究了干、湿条件下，速度、压力与材料摩擦磨损性能的关系，结果表明：影响摩擦磨损性能的重要因素在于载荷性质和第三体状态。在干摩擦条件下，处于低摩擦速度范围时，摩擦力的静载荷性质使第三体呈疏松状态，这增加了微凸体间的啮合程度而使摩擦系数处于较高值。随第三体致密性增加，其润滑作用增强，微凸体间的机械啮合程度减弱，使材料的摩擦系数和磨损量降低。在高速摩擦时，微凸体间的冲击作用使处于摩擦表层的硬质颗粒容易发生粉碎性破损而弥散分布，这强化了表面强度而使摩擦系数有所增加。摩擦压力对高速摩擦性能影响明显，原因在于高负荷加剧了摩擦面的变形和损伤程度。湿摩擦条件下，水膜的润滑和流动具有降低摩擦系数和增加磨损率的作用主要体现在低速低压条件下。在高摩擦速度和高压力条件下，水分的高温蒸发与离心作用明显，破坏了水膜的存在条件，从而使材料的摩擦磨损性能与干摩擦状态相近。

关键词： 铜基复合材料 第三体 摩擦 磨损

Tribological performance of copper matrix composites under dry and wet conditions

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Abstract:

Copper mat rix composites were prepared through powder metallurgic technique. The relationship between speed and pressure of friction and the friction and wear properties of the materials were studied on a pin-on-disk tester in the pressure range of 0. 5～1. 2 MPa under dry and wet conditions. The results demonstrate that thmajor factors affecting the performance are the nature of loading and the state of third bodies. For dry fiction, whe the speed is low, the f riction force is close to static. Such loading allows the third bodies to stay in a porous state increases the level of engagement of asperity, and results in a higher friction coefficient. As the third bodie compact, they provide more lubricating effect, which attenuates the mechanical clenching of asperity, and lowers the friction coefficient as well as wear of the materials. At high speed, hard particulates on the friction surfaces are more likely to be smashed due to impacts among the micro-rises. The broken hard particulates disperse and harden the friction surfaces, causing an increase in the friction coefficient. The friction pressure affects the high speed friction properties significantly because the heavy loading intensifies the deformation and damage of the friction surfaces. Under wet conditions, the effects of flow and lubrication of the water film in lowering the friction coefficient and reducing the wear rate are apparent only at low speed and low pressure. At high speed and high pressure evaporation at elevated temperature and centrifugal action break the water film and consequently the friction and wear properties of the friction materials are similar to those of dry friction.

Keywords: copper matrix composites third body friction wear

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