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微纳技术与精密机械

模具钢表面Co/TiC熔覆层的组织与高温磨损性能

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摘要： 为改善H13热作模具钢表面的热磨损性能，利用6kW横流CO2激光器制备了Co50熔覆层和不同成分配比的Co/TiC复合涂层。借助X射线衍射（XRD），扫描电子显微镜（SEM），显微硬度计和高温摩擦磨损试验机分析了涂层的结合特征，物相组成和不同温度下的摩擦磨损性能。结果表明，当预置层粉末中TiC含量（wt.%）小于等于20%时，熔覆层与H13钢基材呈良好的冶金结合，随着TiC含量的增加，涂层中基体相种类减少。当TiC含量为10%时，基体相由TiCo3、Cr2Ni3和Cr-Ni-Fe-C组成；当TiC含量为20%时，基体相由Cr2Ni3和γ-Co组成；当TiC含量为30%时，基体相为γ-Co固溶体。Co/TiC复合涂层截面平均显微硬度明显高于Co50熔覆层，且随着TiC粉末含量的增加，涂层平均显微硬度呈上升趋势，最高可达824 HV0.2，约为基材的4倍。TiC含量为20%时，复合涂层的高温耐磨性比Co50涂层显著提高，摩擦系数平稳；700℃时复合涂层表面存在大量氧化物，磨损机制主要为氧化磨损和疲劳磨损。

关键词： 激光熔覆 模具钢 Co/TiC复合涂层 微观组织 高温磨损

Microstructure and high-temperature wear behaviors of Co/TiC laser cladding coatings on die steel

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Abstract: In order to improve the wear resistance of AISI H13 hot work die steel, Co50 coating and Co50 composite laser cladding coatings doped with different mass fraction of TiC were prepared by 6 kW transverse-?ow CO2 laser apparatus. The bonding characteristics, phase composition and wear behaviors of the coatings were investigated by XRD, SEM and high-temperature wear tester. The results indicated that Co/TiC composite coatings with the content of TiC (wt.%) less than 20% showed good metallurgical bonding with the substrate surface. In addition, the substrate phase composition of composite coatings tends to be simple with the increasing of TiC content. When the content of TiC was 10%, phase composition of the coating was consisted of TiCo3, Cr2Ni3 and Cr-Ni-Fe-C phases, while the coating containing 20% TiC, its phase composition was Cr2Ni3 and γ-Co, and when TiC content was 30%, phase composition mainly composed of γ-Co solid solution. Micro-hardness of TiC/Co based coatings were significantly higher than that of Co-based coating, furthermore, micro-hardness was increased with the TiC content in the coatings, the highest hardness was 824HV0.2, about 4 times of the substrate. The coating with the content of 20% TiC showed better wear behavior than Co50 coating, as well as had a more stable fiction coefficient and good high-temperature wear property. High-temperature wear behaviors of these coatings were influenced by oxidation, so the wear is mainly caused by oxidation wear and fatigue wear.

Keywords: Laser Cladding Die steel Co/TiC composite coating Microstructure High-temperature wear

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