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论文

激光原位制备复合碳化物颗粒增强铁基复合涂层及其耐磨性的研究

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摘要:

通过在高碳当量铁基熔覆粉末中复合添加多种强碳化物形成元素, 激光原位制备的颗粒增强铁基复合材料涂层具有颗粒析出密度大、尺寸分布均匀的优点. 通过在铁基熔覆粉末中单独添加Ti, 复合添加Ti+Zr以及Ti+Zr+WC的方式, 运用激光熔覆技术在中碳钢表面制备了颗粒增强铁基复合涂层. 用X射线衍射仪、扫描电镜和透射镜等手段研究了涂层的显微组织、颗粒相结构及颗粒相与熔覆层基体相之间的界面. 通过环块磨损实验, 对比渗碳淬火工艺研究了颗粒增强涂层的耐磨性能, 并对磨损机制进行了讨论.结果表明, 涂层微观结构是典型的亚共晶介稳组织, 原位合成的颗粒是一种复合碳化物, 界面处结合牢固. 激光原位制备复合碳化物颗粒增强铁基复合涂层具有优异的耐磨性能.

关键词: 激光熔覆 颗粒增强 复合碳化物 铁基复合涂层 耐磨性

STUDY ON WEAR RESISTANCE OF LASER CALDDING Fe–BASED COMPOSITE COATINGS REINFORCED BY IN–SITU MULTIPLE CARBIDE PARTICLES

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Abstract:

Particle reinforced metal matrix composites (PR–MMCs) have attracted extensive investigation in material science and engineering. They combine both strength and toughness and show excellent properties such as good wear resistance, corrosion resistance and high temperature properties. Laser depositing of metal matrix composite coatings containing in–situ carbide particles is a research focus in laser surface processing. The essential advantage of the in–situ synthesis technology is that the reinforcements are much more compatible with the matrix and the interface between the reinforcements and the matrix is much cleaner. It has a special advantage in high distribution density and dimension uniformity to in–situ synthesize particles by laser melting precursor powders containing several strong carbide-forming elements (SCFEs) rather than one. Each SCFE has significant effects on the precipitation and distribution of the carbide particles. To investigate the microstructure and properties of the cladded ayers, in this paper, the coatings were produced by laser cladding powders containing 2%Ti, 1%Ti+1% Zr and 1%Ti+1%Zr+10%WC (mass fraction) respectively on the surface of a medium carbon steel. The microstructure of the coatings and the carbide particles were studied by X–ray diffractometer (XRD), scanning electron microscopy (SEM) and transmission electron microscopy (TEM). The results show that the microstructure of the coatings is typically hypo–eutectic. The in–situ particles have a TiC structure with high content of Zr or W when 1%Ti+1%Zr and 1%Ti+1%Zr+10%WC are added into the cladded powders. Therefore, they are multiple carbides. The interface between the article and the ae material is strong. The optimized istribution of the particles with high distribution density (2×104 mm−2) and high dimension uniformity (about 1μm) are obtained when 1%Ti+1%Zr+10%WC are added. The wear resistance of the coating was tested throgh ring–on–block wear eperiment. It is indicated that laser cladding Fe–based composite coating reinforced by in–situ multiple carbide particles presents excellent wear resistance.

Keywords: laser cladding particle reinforced mutipe carbide Fe–based composite coating wear reitance

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