

V 对激光熔覆 AlCoCrMoV_x 高熵合金涂层组织、磨损性能的影响廖天海¹ 刘其斌^{1,*}¹贵州大学材料与冶金学院, 贵州贵阳, 550025*Email: qbliugzu@163.com

摘要: 为了提高搅拌桨叶片的使用寿命和耐磨性能, 采用激光熔覆技术在 904L 不锈钢基体上制备了 AlCoCrMoV_x($x=0, 0.2, 0.4, 0.6, 0.8, 1.0$ at.%)高熵合金涂层。利用扫描电镜、透射电镜、显微硬度计、磨损试验机分别研究了 V 含量对涂层的显微组织、显微硬度、耐磨性的影响。实验结果表明, 高熵合金涂层由 BCC 相、针状 σ 相和不规则的黑色 AlN 相组成。随着 V 含量的增加, σ 相逐渐消失。显微硬度的变化趋势为先减小后增大。AlCoCrMoV_{1.0} 高熵合金涂层具有最高的显微硬度(942.6HV_{0.1})。高熵合金涂层的平均摩擦系数先增大后减小, 但在 $x=0.8$ (约为 $0.630 \times 10^{-5} \text{mm}^3 \cdot \text{N}^{-1} \cdot \text{m}^{-1}$) 时比磨损率最低。V 的加入可以减少 σ 相的形成, 从而促使高熵合金涂层形成单一的 BCC 结构, 同时也可以提高涂层的硬度以及耐磨性能。

关键词: 高熵合金涂层, 激光熔覆, 微观组织

Abstract: To improve the service life and wear resistance of the agitator blade, AlCoCrMoV_x ($x=0, 0.2, 0.4, 0.6, 0.8, 1.0$ at.%) high entropy alloy (HEA) coatings were prepared on the 904L-stainless-steel substrate by laser cladding. The effects of V content on the microstructure, microhardness and wear resistance of the coatings were studied by scanning electron microscopy, transmission electron microscopy, microhardness tester and wear tester. The experimental results show that the HEA coatings consist of the BCC phase, needle-like σ phase, and irregular black AlN phase. As the V content increases, the σ phase gradually disappears. The trend of microhardness first decreases and then increases. AlCoCrMoV_{1.0} HEA coating has the highest microhardness (942.6 HV_{0.1}). The average friction coefficient of HEA coatings firstly increases and then decreases, but the specific wear rate is the lowest when $x=0.8$ (about $0.630 \times 10^{-5} \text{mm}^3 \cdot \text{N}^{-1} \cdot \text{m}^{-1}$). The addition of V can reduce the formation of σ phase, promoting the formation of a single bcc structure in the high entropy alloy coating, and can improve the hardness and wear resistance of the coating.

Keywords: High-entropy-alloy coating; Laser cladding; Microstructure;

参考文献

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