

## 激光熔覆 BCC 基共晶高熵合金涂层研究

黄蓉蓉<sup>1</sup>, 匡世华<sup>1</sup>, 周芳<sup>2</sup>

贵州大学材料与冶金学院, 贵州贵阳, 550025

\*Email: 2280160315@qq.com

**摘要:** 共晶高熵合金因具有强韧兼备的特点使其具有广阔的工业应用潜力, 为了获得强韧兼备的难熔共晶高熵合金涂层, 本文利用激光熔覆技术在 M2 高速钢表面制备了 AlFeCrMoNb<sub>x</sub> 共晶高熵合金涂层, 利用 OM、SEM、XRD、显微硬度计、摩擦磨损试验机系统研究了激光工艺参数、Nb 含量对涂层组织结构和性能的影响, 并探索了涂层在 750°C-1050°C 退火 8h 后的组织结构和性能的演变规律。固定 P=1800 W 时, 随激光扫描速度(v=3-5 mm/s)的增加, 涂层由亚共晶组织过渡到过共晶组织, 涂层的硬度和耐磨性上升。当 P=1800 W、v=3 mm/s 时, 对于 AlFeCrMoNb<sub>x</sub> (x=1.0, 1.2, 1.4, 1.6, 1.8, 2.0) 涂层, 随着 Nb 含量的升高, 涂层组织由亚共晶向过共晶转变; 当 x=1.8 时, 可获得具有片层结构的 (BCC+Laves) 共晶体, 其硬度和磨损体积分别为 702 HV<sub>0.2</sub>, 0.16 mm<sup>3</sup>, 较基材分别提升了 2.5 倍和 3.6 倍。AlFeCrMoNb<sub>1.8</sub> 共晶高熵合金涂层在 750°C 退火后, 涂层的显微组织、硬度和耐磨性与熔覆态相差不大, 其硬度和磨损体积分别为 670HV<sub>0.2</sub>, 0.122 mm<sup>3</sup>, 表明其具有良好抗高温软化性能。

**关键词:** 共晶高熵合金; 激光熔覆; 激光工艺参数; 组织结构; 高温性能

\*第一作者(报告人)联系方式: 黄蓉蓉、19184517886、2280160315@qq.com

## Study on BCC based eutectic high entropy alloy coating fabricated by laser cladding

Rongrong Huang<sup>1</sup>, Shihua Kuang<sup>1</sup>, Fang Zhou<sup>2</sup>

College of Materials and Metallurgy, Guizhou University, Guiyang 550025, PR China

\*Email: 2280160315@qq.com

**Abstract:** Eutectic high-entropy alloys can simultaneously possess high strength and high ductility, which have potential applications in industrial fields. In order to obtain refractory eutectic high entropy alloys (REHEAs) coating with both strength and toughness, a series of AlFeCrMoNb<sub>x</sub> HEA coating was fabricated by laser cladding on M2 high-speed steel. The effects of laser processing parameters and Nb content on the microstructure and properties of the coatings were systematically studied by OM, SEM, XRD, micro-hardness tester and wear tester, and the evolution law of the microstructure and properties of the coating after annealing at 750°C-1050°C for 8 h was explored. When P=1800 W, with the increase of scanning speed (v=3-5 mm/s), the microstructure of coating changes from hypoeutectic to hypereutectic, and the hardness and wear resistance of the coating increase. For AlFeCrMoNb<sub>x</sub> (x=1.0, 1.2, 1.4, 1.6, 1.8, 2.0) coatings, when P=1800 W and v=3 mm/s, the microstructure of coating changes from hypoeutectic to hypereutectic as the Nb content increases; at x=1.8, the (BCC+Laves) eutectic with lamellar structure is obtained, and the microhardness and volume loss of coating are 702 HV<sub>0.2</sub> and 0.16 mm<sup>3</sup>, respectively.



2022

# 第十五届全国激光加工学术会议

15<sup>th</sup> National Conference on Laser Processing

2022年10月 | 武汉

After annealing at 750°C, the microstructure, hardness, and wear resistance of AlFeCrMoNb<sub>1.8</sub> EHEA coating are similar to those of as-cladded coating, which indicates that it has good softening resistance at high temperature.

**Key words:** Eutectic high-entropy alloy, Laser cladding, Laser process parameters, Microstructure, High temperature performance