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# Effect of process parameters on microstructure and properties of AlCoCrFeNi-WC-$WS_2$ composite coating prepared by laser cladding

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To further enhance the hardness, wear, and corrosion resistance of high-entropy alloy (HEA) coatings, an AlCoCrFeNi-WC-$WS_2$ composite coating was prepared on the surface of cast iron using laser cladding technology. X-ray diffraction (XRD), scanning electron microscopy (SEM), energy-dispersive X-ray spectroscopy (EDS) analyses as well as microhardness, friction and wear, and electrochemical tests were performed to characterize and analyze the phase structure, composition, and forming quality of coating. The effects of process parameters such as laser power and scan rate on the microstructure and properties of coating were evaluated. With the increase in laser power, the amount of unmelted powder, cracks, and pores gradually decreases inside the coating, and the thickness and density increase. The coating is mainly composed of face-centered cubic (FCC) phase, carbide-reinforcing phase, and $WS_2$ self-lubricating phase. WC and its in situ synthesized chromium and iron carbide increased the hardness of coating by 3-4 times of the substrate, and the maximum hardness can reach 1187.2 HV. $WS_2$ exists as the self-lubricating phase in the coating, ensuring the formation and stability of lubricating film during friction and wear, helping the coating have favorable wear resistance. In addition, a compact passive film is formed by the corrosion-resistant elements Co, Cr, and Ni, enabling the coating to have great corrosion resistance in 3.5 wt% NaCl solution.

**Keywords:** Composite coating; carbide reinforcing phase; in-situ synthesis; solid lubricant; self-lubricating phase

FULL TEXT