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PROCEEDINGS

Simulation Analysis of in-Situ TiC Generation by Laser Cladding and Study on Mechanical Properties of Enhanced Coatings

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ABSTRACT

Based on COMSOL simulation software, the planar Gaussian heat source model was used to simulate and analyze the surface reinforced nickel-based coating on H13 steel, and the optimal process parameters were obtained. Secondly, TiC reinforced nickel base coating was prepared in situ on H13 steel surface by laser cladding technology. The morphology, phase composition, microhardness and friction and wear properties of matrix, single coating and gradient coating were compared by scanning electron microscopy, X-ray diffractometer, microhardness tester and universal friction and wear machine. Finally, the bionic gradient TiC reinforced nickel base coating was prepared on the surface of H13 steel, and the phase structure, microhardness and wear properties of different gradient coatings were compared and analyzed. The results show that when the laser power is 2500W, the scanning speed is 2mm/s, and the powder feeding voltage is 10V, the coating equivalent stress is minimum, the coating has no defects such as cracks and pores, and the coating morphology is good. The single coating is prone to defects such as macroscopic pores, cracks and poor interface joints, while the gradient coating can achieve changes in composition and microstructure properties, and form a good metallurgical bond with the matrix. The average hardness of the gradient coating is about 1.47 times that of the single coating, about 3.2 times that of the matrix, and the average wear is about 10.2% of the single coating and 18.3% of the matrix. By changing the inner （Ti+C） content of the coating, the hard phase content and microstructure are changed. When the content of（Ti+C） powder is high, a large number of TiC dendrites are formed inside the coating. When the （Ti+C）powder content is low, a large number of TiC particles are formed inside the coating. The microhardness of TiC dendrite coating is higher than that of granular coating. The maximum microhardness of TiC dendrite coating is 853.5$HV_{0.5}$, and that of TiC granular coating is 455.5$HV_{0.5}$.

KEYWORDS

Simulation analysis; laser cladding; gradient coating; friction and wear; in situ generation; microhardness

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