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Effects of pulse parameters on in-situ Ti-V carbides size and properties of Fe-based laser cladding layers

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Abstract: The effects of duty cycle and pulse frequency on the carbide size and properties of in-situ TiC-VC reinforced Fe-based cladding layers were studied. Heat input increased and carbide particle sizes decreased with increasing numbers of duty cycles. As the pulse frequency increased from 5 Hz to 5000 Hz, carbide particle sizes first increased and then decreased. Carbide refinement was mainly induced by a rapid cooling rate at low pulse frequencies, and high-speed Marangoni flow in the molten pool at high pulse frequencies. The hardness and corrosion resistance of cladding layers varied inversely with carbide particle size. The 5 Hz cladding layer had the highest hardness and best corrosion resistance, while the 500 Hz layer showed poor properties because of carbide agglomeration.

Key words: laser cladding; pulse frequency; duty cycle; carbides size; corrosion resistance

1.Introduction

Compared with other surface modification and strengthening techniques, such as hardfacing [1], spraying [2], chemical and physical vapor deposition [3-5], and