Effects of CeO₂ on Microstructural Evolution, Corrosion and Tribology Behavior of Laser Cladded TiC Reinforced Co-based Coatings

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doi: 10.20964/2021.05.10

Received: 17 December 2020 / Accepted: 8 February 2021 / Published: 31 March 2021

TiC/Co-based composite coatings with different CeO₂ contents were successfully fabricated on 9Cr ferritic steel by laser cladding. The effects of CeO₂ on microstructure, corrosion and wear resistance of laser cladded TiC/Co-based composite coatings were investigated systemically. X-ray diffractometer (XRD) results showed that the coating layers consisted of four types of intermetallic phases, γ -Co, TiC, TiWC₂ and Cr₂₃C₆. TiC and TiWC₂ precipitates played a significant role in the corrosion and wear resistance of the cladding layer. Energy dispersive spectrometer (EDS) analyses indicated that the TiC is coated by the TiWC₂. The rare earth oxides could act as the nucleation positions for precipitates. Furthermore, the morphology and distribution of precipitates were significantly affected by CeO₂ additions. The corrosion resistance, micro-hardness, and wear resistance of the composite coatings increased first and then decreased as CeO₂ content increased. Appropriate addition of CeO₂ (1.5 wt.%) could lead to the refinement and uniform distribution of precipitates, resulting in the improvement of the corrosion resistance, hardness, and wear resistance. Excessive addition of CeO₂ could cause the accumulation of some precipitates, resulting in the uneven distribution of precipitates again, thereby reducing the corrosion resistance, hardness, and wear resistance of the cladding layer.

Keywords: TiC/Co-based composite coating, CeO₂, Microstructure, Corrosion resistance, Wear resistance

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