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ORIGINAL PAPER

Evaluation and Selection of Optimal Oxygen/Fuel Ratio for Best Mechanical Properties, Oxidation Resistance and Microstructure of HVOF NiCoCrAlY Coatings Using AHP–VIKOR Method

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Abstract This work describes coating of NiCoCrAlY on IN-738LC superalloy by high-velocity oxygen fuel (HVOF) process. Properties of the coatings are significantly influenced by oxygen/fuel ratio and other spraying parameters. The effect of oxygen/fuel ratio on the oxidation behavior, bond strength, hardness, roughness and microstructure including porosity, inclusion formation and unmelted particles are discussed here. The porosity and inclusion in C1 coating are maximal. C2 coating with oxygen/fuel ratio of 2 has the highest bond strength and the lowest unmelted particles. C3 coating with the lowest total porosity and inclusion has the minimal roughness and the highest oxidation resistance and hardness among all candidate coatings. C5 coating with oxygen/fuel ratio of 3 has the highest unmelted particles and roughness, and has the lowest inclusion. Oxygen/fuel ratio for optimal HVOF NiCoCrAlY coating is selected by using analytic hierarchy process (AHP–VIKOR) to achieve best microstructure, mechanical properties and oxidation resistance at 1100 °C. Results show that the best selection is C3 coating with oxygen/fuel ratio of 2.27 (820/360). This is in good concordance with empirical findings.

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