THERMALLY SPRAYED HIGH ENTROPY STAINLESS STEEL COATINGS: MICROSTRUCTURE AND PROPERTY EVALUATION

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FeCrMoWBSi coatings have been deposited on austenitic stainless steel by HVOF (High Velocity Oxygen Fuel) spraying. Three spraying series have been conducted, where the oxygen to fuel ratio is the principal variable.

The feedstock powder is partially amorphous. Crystalline phases include martensite, Cr-rich borides, Fe-rich borides and (W,Mo) carbides. During spraying, a critical oxygen to fuel ratio is necessary for achieving a maximum flame temperature. Ratios higher than this critical value lead to reduced flame temperature despite the high power output; sub-critical ratios also lead to reduced flame temperatures.

All the coatings exhibit good uniformity, low porosity and high adhesion strength. The coatings sprayed at the critical oxygen to fuel ratio present the lowest porosity and the highest amorphous fraction. All the coatings present lower crystallinity than the initial powder. The nature of the crystalline phases in the coatings is discussed and correlated with annealing and dissolution processes during spraying, as well as with solidification and quenching processes during cooling.

Upon cyclic potentiodynamic polarization, all the coatings show pseudopassivity in 3.5% NaCl. They are susceptible to localized corrosion; nevertheless they repassivate. The high amorphicity positively affects the corrosion performance in terms of electrochemical values and localized corrosion resistance.