

Study on the Microstructure and Oxidation Behavior of Incoloy 800H Coating Deposited by Electro-Spark Deposition

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Abstract Incoloy 800H possesses considerable high-temperature mechanical properties and oxidation resistance. In this study, 800H coating was deposited on the surface of 316L stainless steel using a self-built automated Electro-Spark Deposition (ESD) platform to explore its oxidation resistance in a 650°C pure steam environment. The 316L with 800H coating, bulk 800H and 316L substrate were included in the isothermal oxidation test. The results show that the microhardness of bulk 800H is significantly greater than that of bulk 316LN, and the microhardness of the 800H coating is slightly higher compared to the bulk 800H. The microhardness of the 800H-coated 316L gradually decreases from the outside 800H coating to the inside 316L matrix. EBSD cross-section examination demonstrated that the 800H coating consisted of small columnar grains with grain size down to several hundred nanometers. The 800H coating, bulk 800H and 316L were all fully austenitic. The content of Fe, Cr, Ni, and Mo elements in the coating shows significant changes from the surface of the coating to the substrate, indicating that there is mutual diffusion and mixing of elements between the coating and the substrate rather than simple mechanical bonding. After high-temperature steam exposure, the weight gain of bulk 316L was the highest, followed by 800H-coated 316L. The bulk 800H had the lowest weight gain. It indicates that the ESD 800H coating can improve the oxidation resistance of the 316L substrate.

Keywords Electro-Spark Deposition, Coating, Incoloy 800H, 316L, Oxidation.