16、High-temperature Resistant Materials and Coatings

High temperature oxidation, hot corrosion and friction behavior of atmospheric plasma sprayed Co-Cr-Ni-W coatings

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Abstract High-temperature oxidation, hot corrosion, and wear damage will occur during the service of high-temperature alloy turbine components of engines. Cobalt-based high-temperature alloy coatings have excellent oxidation resistance, hot corrosion resistance, and wear resistance. In this study, a Co-Cr-Ni-W alloy coating was fabricated on the surface of Inconel 718 high-temperature alloy substrate using atmospheric plasma spraying (APS) technology. The microstructure, high-temperature oxidation performance, hot corrosion performance, and friction and wear performance of the coating were investigated. The results of the high-temperature oxidation test showed that the Co-Cr-Ni-W coating exhibited superior high-temperature stability, without any damage phenomena such as spalling and delamination. With the extension of oxidation time, two new spinel oxide phases ($CoCr_2O_4$ and Co_3O_4) were generated on the coating surface to resist further oxygen erosion. Internal oxidation initiated near the coating surface and propagated towards the coating/substrate interface. In the hot corrosion test, the Co-Cr-Ni-W coating formed $CoCr_2O_4$ spinel oxide and Cr_2O_3 oxide to resist the erosion of thermal corrosion media and oxygen. With the prolongation of thermal corrosion time, the protective oxide on the coating surface underwent a transformation from Cr_2O_3 to $CoCr_2O_4$. In the wear test, as the load increased, the friction coefficient of the Co-Cr-Ni-W coating decreased, showing excellent wear resistance. The wear mechanism of the Co-Cr-Ni-W coating featured a mixed characteristic of abrasive wear, fatigue wear, and oxidation wear.

Keywords Co-Cr-Ni-W coating; Atmospheric plasma spraying (APS), Oxidation; Hot corrosion; Wear and friction; Nickel-based superalloy