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Hot Corrosion and Oxidation Degradation Mechanism of Turbine Materials in a Water Vapor Environment at a Higher Temperature

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Abstract : This study employed Rene N4 and FSX 414 superalloys, which are used in numerous turbine engine components due of their high strength, outstanding fatigue, creep, thermal, and corrosion-resistant properties. An in-depth examination of corrosion mechanisms with vapor present at high temperature is necessary given the industrial trend toward introducing increasing amounts of hydrogen into combustion chambers in order to boost power generation and minimize pollution in contrast to conventional fuels. These superalloys were oxidized in recent tests for 500, 1000, 2000, 3000 and 4000 hours at 982±5°C temperatures with a steady airflow at a flow rate of 10L/min and 1.5 bar pressure. These superalloys were also examined for wet corrosion for 500, 1000, 2000, 3000, and 4000 hours in a combination of air and water vapor flowing at a 10L/min rate. Weight gain, X-ray diffraction (XRD), scanning electron microscopy (SEM), and energy dispersive x-ray spectroscopy (EDS) were used to assess the oxidation and heat corrosion resistance capabilities of these alloys before and after 500, 1000, and 2000 hours. The oxidation/corrosion processes that accompany the formation of these oxide scales are shown in the graph of mass gain vs time. In both dry and wet oxidation, oxides like Al2O3, TiO2, NiCo2O4, Ni3Al, Ni3Ti, Cr2O3, MnCr2O4, CoCr2O4, and certain volatile compounds notably CrO2(OH)2, Cr(OH)3, Fe(OH)2, and Si(OH)4 are formed.

Keywords : hot corrosion, oxidation, turbine materials, high temperature corrosion, super alloys
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