Effect of Water Vapor on Oxide Scale Microstructure

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The presence of water vapor in the environment can have a substantial effect on the high temperature oxidation behavior of many alloys. However, the mechanistic role of water vapor is poorly understood. In order to provide additional microstructural information on the effect of water vapor, the scales formed on alumina- and chromia-forming alloys were examined after exposure to air and air plus 10vol.% water vapor. Characterization included cross-sectional metallography, scanning electron microscopy and cross-sectional transmission electron microscopy. In general, the scales examined after short oxidation times (100-500 h) were not significantly different with and without water vapor. On a type-321 austenitic stainless steel specimen, regions that formed a thin Cr-rich oxide were thinner after exposure to water vapor at 700°C. The microstructure of alumina scales formed on PM2000 (FeCrAl) and Haynes 214 (NiCrAl) showed only minor differences with the addition of water vapor at 1000° and 1100°C, respectively.

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