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Oxidation behavior of ultra-high-strength 13Ni15Co10Mo maraging steel

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Abstract

During solution annealing and aging of maraging steels an oxide layer is formed, usually composed of hematite and/or magnetite. Exploratory analysis of the oxidized surface of 13Ni-15Co-10Mo (wt.%) maraging steel also indicated the presence of austenite. This maraging steel presents ultra-high yield strength (~3 GPa), however, it shows lower toughness than other maraging steel types and the austenite phase on the surface could obstruct crack initiation and propagation improving toughness. The aim of this study was to investigate the microstructure of the steel surface after oxidation in air by Scanning Electron Microscopy (SEM), Energy Dispersive X-Ray Spectroscopy (EDX) and X-Ray Diffraction (XRD). Results showed that there are three different regions after oxidation: bulk (constituted of martensite and nanometric precipitates), an intermediate thin layer (composed by austenite, martensite and oxides) and an external layer (constituted of oxides like hematite, magnetite and kamiokite). Chemical microanalysis indicated that the intermediate layer is richer in Ni and Co (austenite stabilizers). Besides identifying the different phases and chemical compositions through the material, from the surface to the bulk, it was possible to understand how austenite is formed during oxidation.

Keywords: Oxidation, maraging steel, oxide layer, austenite formation

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