Effect of aging precipitation on the stress corrosion cracking behavior of Ni(Fe, Al)-maraging steel

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Abstract The effect of aging precipitation on the stress corrosion cracking (SCC) mechanism of Ni(Fe, Al)-maraging steel was studied through comparative characterizations and analyses on microstructures and fracture features of the solid-solution and peak-aged steels. Aging precipitation brings a chain of impacts on the deformative compatibility and electrochemical difference between the matrix and other phases or interfaces. The strength of the martensite matrix is enhanced by the abundant and evenly dispersed Ni(Fe, Al) precipitate, thereby reducing the possibility of splitting across the martensite laths. Meanwhile, the Volta potential difference between the matrix and the primary NbC particles is increased from 11.3mV to 18.60mV. Since most of the primary NbC particles tend to be distributed along high-angle grain boundaries (HAGBs), the anodic dissolution along HAGBs is accelerated. Therefore, both the mechanical and electrochemical factors, triggered by aging precipitation, are involved in the variation of SCC behavior and mechanism. The SCC susceptibility of the steel is increased along with the increasing tendency of intergranular cracking.

Keywords Maraging steel, Stress corrosion cracking, Precipitation, Anodic dissolution behavior, First-principles calculation.