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Anodic Polarization Study on F82H Steel in Tritiated Water

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Since it is predicted from the previous studies that the effects of tritium on corrosion of F82H steel, one of Reduced Activation Ferritic Martensitic Steels, would be higher than that of SUS304 stainless steel, a corrosion behavior of F82H steel in tritiated water circumstance was studied by means of anodic polarization measurements, one of the electrochemical techniques, with changing the tritium concentration and dissolved oxygen concentration in 0.05 M sodium sulfate solution at 293 K. The experimental results indicate that the self-passivation of F82H steel induced by dissolved oxygen was inhibited in tritiated water solution at ambient temperature. If passivation of F82H steel would not proceed, the surface was kept corrosive and therefore the corrosion would be enhanced. Furthermore, when dissolved oxygen, which is necessary to make F82H steel self-passivated under the present experimental condition, coexisted with tritium, the corrosion of F82H steel became much less apt to be passivated: Even the electrochemical passivation was inhibited. Similar phenomenon has been investigated for SUS304 stainless steel, indicating that the key reaction was supposed to be elution of chromium during passivation by further oxidation induced by oxidative radiolysis products such as hydroxyl radical, super-oxide radical and so on. Therefore, it is indicated that the mechanism of the tritium effects on the passivation of F82H steel would be similar to or the same as that of SUS304 stainless steel, since the chromium plays an important role in the passivation of F82H steel as well as SUS304 stainless steel. It was found from the present results that the effects of tritium on corrosion of F82H steel would not be negligible problem to design the blanket and the other relevant components since radiochemical reactions are generally less susceptible to temperature.

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