Short Communication

Effects of Aluminium Addition on the Oxide Film Formed on 304 Stainless Steel in the Simulated Primary Circuit of the PWR

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Aluminium (Al^{3+}) addition in the simulated primary circuit of the pressurized water reactor (PWR) was investigated based on its effect on the oxide film formed on 304 stainless steel (SS). SEM images showed the formation of more compact oxide films after Al^{3+} addition. Deposition of cobalt was inhibited by Al^{3+} addition according to the results from EDX and XPS. Potentiodynamic polarization analysis demonstrated that the corrosion potential of the oxide films observably increased and that the corrosion current density remarkably decreased after Al^{3+} addition. Mott-Schottky plots showed that the semiconductor properties of the oxide films could be changed by Al^{3+} addition. These results revealed the composition and structure changes of the oxide films that resulted in corrosion inhibition of 304 SS and prevention of the radiation field build-up of Co^{2+} in the simulated primary circuit of the PWR. The current work offers a good solution for corrosion and radiation build-up of structural materials in many nuclear plants.

Keywords: Aluminium addition, 304 Stainless steel, Pressurized water reactor, Oxide film.

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