Formation of Fe-Sn intermetallic layer and its effect on the corrosion of 304 stainless steel in high temperature water

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Fe-Sn compound layer on interface was studied during the interaction between liquid Sn and 304 stainless steel (304 SS), and the effect of the intermetallics on the corrosion of 304 SS in 300 °C high temperature water was researched. The experimental results indicate that a (Fe, Cr)Sn₂ compound layer forms at the Sn/304 SS interface. The average thickness of the layer is in proportion to square root of reaction time, indicating a diffusion control process for the intermetallics growth. After corrosion in 300 °C water, the (Fe, Cr)Sn₂ layer changes surface oxide film composition from hematite Fe₂O₃ and spinel Fe₃O₄ to SnO₂ and spinel Fe₃O₄. Microcracks and spallation tendency in the oxide films is due to the Fe-Sn intermetallics attachment. From the potentiodynamic polarization, the oxide film that formed on stainless steel with Fe-Sn intermetallics attachment significantly deteriorated the corrosion resistance compared with that the samples without intermetallics attachment.

Keywords: Sn, Stainless steel; Intermetallics, liquid-solid reactions, Oxidation, High temperature water

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