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Corrosion Behavior of Fe-Ni-Cr and Zr Alloys in Supercritical Water Reactors

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Abstract : Progress in advanced energy technologies is not feasible without understanding how engineering materials perform under extreme environmental conditions. The corrosion behaviour of Fe-Ni-Cr and Zr alloys has been systematically examined under high-temperature and supercritical water flow conditions. The changes in elemental release rate and dissolved gas concentration provide valuable insights into the mechanism of passivation by forming oxide films. A non-intrusive method for monitoring the extent of surface oxidation based on hydrogen release rate has been developed. This approach can be used for the on-line monitoring corrosion behavior of reactor materials without the need to interrupt the flow and remove corrosion coupons. Surface catalysed thermochemical reactions may generate sufficient hydrogen to have an effect on the accumulation of oxidizing species generated by radiolytic processes in the heat transport systems of the supercritical water cooled nuclear reactor.

Keywords : high-temperature corrosion, non-intrusive monitoring, reactor materials, supercritical water
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