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R-365

MIXED OXIDE-ALLOY-WATER SYSTEMS UNDER LWR CONDITIONS

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Objectives: To calculate the potential-pH diagrams for Fe-Cr-Ni alloys and for Fe-Zn systems, showing the regions of stability for mixed oxides.

Comments: The diagrams are only first approximations to the water-alloy equilibrium. They emphasize the fact that mixed oxides can form on the metal surface, with substantial impact on the pH-potential fields of stability and hence on the corrosion behavior of the metal. Better diagrams can be calculated when thermodynamic data become available for the Gibbs energy of formation of: a) the mixed oxides, especially those containing three or more metals, b) the ions in solution, which were approximated values.

Remarks/Potential for dose limitation: The corrosion of construction materials causes problems for reactors in the hot water in BWRs and PWRs, and in the room temperature water of service water systems. In corrosion processes, one must consider the kinds of films formed on the surface of the corroding metal, which are different for alloys from pure metals because of the formation of mixed oxides involving two or more of the constituent elements. To help in the corrosion analysis of alloys, the potential-pH diagrams were calculated.

References: Cubicciotti, D., "Mixed Oxide-Alloy-Water Systems Under LWR Conditions," *Water Chemistry of Nuclear Reactor Systems 6*, Vol. 1, pp. 206-207, British Nuclear Energy Society, London, 1992.

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