Alloy 690 Base Metal Product Forms

Peter Andresen

GE Global Research

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Alloy 690 Base Metal Evaluation

SCC growth rate data shows significant variability in base metal microstructure (esp. compositional banding) and an associated high growth rate potential in the banded structure.

Cold work / deformation accelerates SCC by perhaps 10X in excellent microstructures, but ~100X in banded structures.

Weld shrinkage immediately adjacent to the fusion line represents a large and consistent source of cold work – peaking at 20 – 30% equivalent room temperature cold work at the weld root.

Other sources of cold work should be defined / catalogued.

Alloy 690: Key Parameters for Evaluation

- *Ingot melting practice, including cleanliness and chemical homogeneity.*
- *The efficiency of the conversion route used to fully transform the cast ingot to an equiaxed structural material in terms of grain size, grain size homogeneity, chemical homogeneity, and carbide distribution uniformity.*
- *Heat and product form (e.g., billet vs. plate) variability due to very different ingot conversion routes.*

Alloy 690: Key Parameters for Evaluation

- *Effect of thermal treatment (TT), e.g., at 705 C for ~8 hours, designed to produce a high density of grain boundary carbides.*
- *Effect of deformation and crack orientation. The worst case is typically material cold rolled in one direction, with the crack plane oriented along the rolling plane. Some spreading occurs during rolling, so there is undoubtedly a continuum among 1D cold rolled, cross-rolled and forged materials. In turn, SCC response in tensile strained and HAZ-aligned specimens is also important.*

Alloy 690: Key Materials

1. *~250 pounds each of two double-melted heats of 4 – 7 inch diameter Alloy 690 billet*
2. *~250 pounds each of two double-melted heats of 2 – 4 inch thick Alloy 690 plate*
3. *We would like to have some of the plate cold rolled in one-direction to 10, 20 and 30% reduction*

Accumulating more forms/heats and types/orientations-of-deformation will eventually be necessary to have confidence in our understanding of material and deformation effects.