

## **SPC-7 An Investigation of the Cracking Susceptibility of Hastelloy C-22**

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### **Introduction**

Hastelloy C-22 is the most corrosion resistant Ni-Cr-Mo alloy available today, and is particularly versatile. As a result, Hastelloy C-22 is being considered for use in the construction of storage canisters for permanent disposal of radioactive waste in the Yucca Mountain Project. Unfortunately, limited weldability data on Hastelloy C-22 is available to date. If proper precautions are not followed, both hot and warm cracking may occur in Ni-based alloys during fabrication involving welding. In order for C-22 to be used within the Yucca Mountain Project, a high level of confidence on the weldability of this alloy must be obtained.

### **Technical Approach and Results**

Hot cracking is a phenomenon caused by the application of weld shrinkage stress on locations that are liquated due to low melting liquid films resulting from partitioning during solidification. In this investigation, the hot cracking susceptibility of Hastelloy C-22 will be quantified using the transvarestraint test. Warm cracking, also known as Ductility Dip Cracking (DDC), is a solid-state cracking phenomenon occurring below the effective solidus temperature of highly restrained austenitic alloys. The warm cracking susceptibility of Hastelloy C-22 will be quantified using the Strain to Fracture (STF) test.

Initial transvarestraint testing has been conducted on two heats of Hastelloy C-22 donated by Haynes International. The primary measure of the susceptibility of the alloy to hot cracking will be the Solidification Cracking Temperature Range (SCTR). In addition to hot cracking, DDC cracking was observed in some transvarestraint samples subjected to high levels of strain. STF testing to quantify the DDC susceptibility of the alloy is currently underway.

Future work includes: metallographic characterization of hot and warm cracked samples, and determination of the effect of compositional variation on the hot and warm cracking behavior of the alloy. Finally, procedures to minimize or avoid hot and warm cracking in Hastelloy C-22 will be recommended.

### **Conclusions**

Initial Varestraint and STF testing of Hastelloy C-22 have provided a baseline for future investigation into the cracking susceptibility of the alloy. Further testing of compositionally varied heats of the alloy are necessary before recommendations on minimizing or avoiding cracking of this alloy can be made.