Abstract and Objective

Technical Review Meeting

Evaluation of Welding Issues in High Nickel and Stainless Steel Alloys for Advanced Energy Systems

Sponsor: DOE SCO2 Power Cycle Crosscut Team - DOE Offices of Energy Efficiency and Renewable Energy, Fossil Energy and Nuclear Energy

Invitation Only
Attendees Must be US Citizens

Abstract: The US DOE has made significant investments in high nickel alloys to support high temperature and high pressure applications in advanced energy systems. These systems include concentrated solar power, coal-fired boilers and nuclear power plants that use a power cycle with supercritical carbon dioxide (SCO2) as the working fluid. Over the past 15 years the DOE Office of Fossil Energy has worked with industry to develop the Inconel® 740 H material. Currently the US DOE SCO2 Crosscut Team is using these advanced materials in the Supercritical Transformational Electric Power (STEP) 10 MW SCO2 Power Cycle Pilot Plant Facility. One of the goals of the STEP facility is to demonstrate a pathway towards 50 % cycle efficiency for the recompression Brayton cycle based on SCO2 as the working fluid. To this end the turbine in this power cycle will operate with a turbine inlet conditions as high as 715 °C and 250 Bar. The natural gas fired primary heater (~ 50 MW_{th}) for this facility, that will support these turbine inlet conditions, was designed and built by Optimus Inc. and includes extensive use of the 740 H material as tubing in the heat exchanger coils, as thick walled pipe sections, and as fittings. This heater application is currently the largest use of 740 H material in the world. The heater fabrication process required approximately 1,600 welds with prescribed heat treatment. These welds have resulted in post weld heat treatment related cracking issues either due to stress reheat or stress relaxation.

To better understand these cracking issues and to share lessons learned the DOE SCO2 Crosscut Team is hosting the meeting outlined below. The meeting will address the common issues of cracking of 740 H and SS347H encountered by the DOE applications as well as consider potential issues for the Inconel® 617 and Haynes 282 materials in future applications.

Meeting Objectives:

(1) Disseminate pre-competitive technical information relevant to the welding of high nickel alloys and stainless steels, and
(2) Exercise the communication and information sharing mission of the DOE SCO2 Power Cycle Crosscut Team.