

LEHIGH ENERGY UPDATE

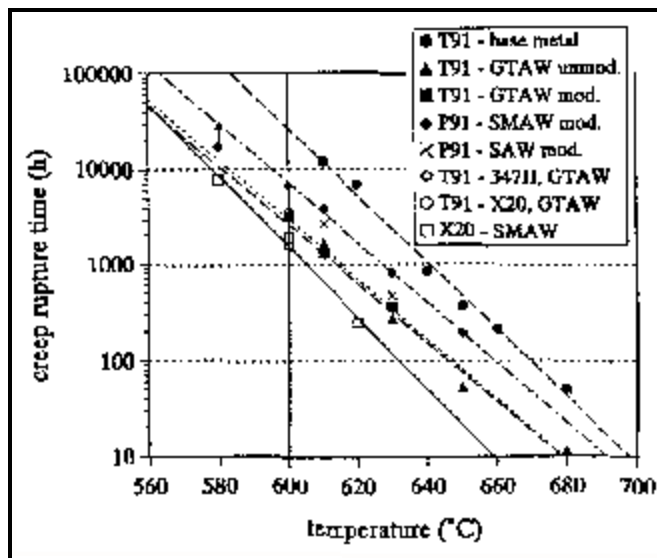


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PROJECT ON WELDING OF 9Cr-1Mo STEELS SEEKS SPONSORS

The family of 9Cr-1Mo steels is a relatively new class of materials used for elevated temperature service in power plants. Typical applications include super-heaters, reheaters, headers, and main steam lines. This new alloy is used extensively in Heat Recovery Steam Generators (HRSGs). Compared to stainless steels, the 9Cr-1Mo material possesses lower thermal expansion and higher thermal conductivity, thus reducing thermally-induced stresses. In addition, the alloy is more resistant to stress corrosion cracking and does not sensitize during welding or elevated temperature exposure. Compared to 2.25Cr-1Mo steels, the 9Cr-1Mo alloy offers better high temperature strength and greater resistance to atmospheric corrosion during plant construction and outages.

The microstructure and mechanical properties of 9Cr-1Mo steels are obtained by careful control of heat treatment schedules. However, welding and post weld heat treatment (PWHT) can considerably alter the base metal microstructure and resultant properties. Unfortunately, not enough is known about how to perform PWHT on this material to assure good quality welds with adequate creep life. This is illustrated by the Figure which shows creep rupture times of T-91 base metal compared to welds made with various welding processes (SAW, SMAW, GTAW). In all cases, weld failure occurred prematurely with significant



Creep Rupture Properties of Various Weldments in T-91 Compared to the Base Metal

reduction in creep life. More work is needed to determine optimal PWHT schedules based on both performance and economic considerations.

A workshop was recently held at Lehigh University to discuss issues associated with welding new power plant alloys. The workshop consisted of personnel from power companies, equipment manufacturers, and academia. At the conclusion of the workshop discussions, it became clear that detailed information on fabrication issues such as welding procedures, filler metal selection, and PWHT schedules is not yet available to ensure full restoration of the weld and heat affected zone properties of 9Cr-1Mo alloys. In response to this need, the Energy Research Center has developed a research proposal to address these issues. The

research will begin with a comprehensive literature review in order to provide a detailed summary of work conducted to date in the areas of welding, fabrication, service history, and failure mechanisms. Fabrication guidelines will be formulated from this review and provided to project sponsors. A research plan will then be pursued in order to develop more detailed fabrication guidelines in areas that have not been addressed to date. Several utility companies have already expressed an interest in supporting the program, but two additional sponsors are needed to provide the remaining funds needed to carry out this project. Please contact John DuPont at (610) 758-3942 or at jnd1@lehigh.edu, if you are interested in becoming a project member or learning more about the program. #