HEAT-TO-HEAT VARIABILITY OF IRRADIATION CREEP AND SWELLING OF HT9 IRRADIATED TO HIGH NEUTRON FLUENCE AT 400-600°C -

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EXTENDED ABSTRACT

Irradiation creep data on ferritic/martensitic steels are difficult and expensive to obtain, and are not available for fusion-relevant neutron spectra and displacement rates. Therefore, an extensive creep data rescue and analysis effort is in progress to characterize irradiation creep of ferritic/martensitic alloys in other reactors and to develop a methodology for applying it to fusion applications.

In the current study, four tube sets constructed from three nominally similar heats of HT9 subjected to one of two heat treatments were constructed as helium-pressurized creep tubes and irradiated in FFTF-MOTA at four temperatures between 400 and 600°C. Each of the four heats exhibited a different stress-free swelling behavior at 400°C, with the creep rate following the swelling according to the familiar $B_o + D\dot{S}$ creep law. No stress-free swelling was observed at the other three irradiation temperatures.

Using a stress exponent of $n = 1.0$ as the defining criterion, "classic" irradiation creep was found at all temperatures, but, only over limited stress ranges that decreased with increasing temperature. The creep coefficient B_o is a little lower (~50%) than that observed for austenitic steel, but the swelling-creep coupling coefficient D is comparable to that of austenitic steels. Primary transient creep behavior was also observed at all temperatures except 400°C, and thermal creep behavior was found to dominate the deformation at high stress levels at 550 and 600°C.

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