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A systematic study is currently being conducted at Argonne National Laboratory (ANL) to evaluate the uniaxial creep behavior of V-Cr-Ti alloys as a function of temperature in the range of 650-800°C and at applied stress levels in the range of 75-380 MPa. At present, the principal effort has focused on the V-4Cr-4Ti alloy of Heat 832665; however, another heat of a similar alloy from General Atomics (GA) will also be used in the study.

Extruded V-4Cr-4Ti bar stock from ANL's 500-kg 832665 heat and swaged rod stock from GA's 1000-kg 832864 heat were examined using optical microscopy and transmission electron microscopy to determine whether they are suitable feedstock for the upcoming creep tubing fabrication campaign. To compare microstructure, 832665-heat creep tubing from the last fabrication campaign was also examined. The results of this study show a banded (stringer) structure, consisted of fine Ti-rich particles, exists in both the 832665 and 832864 bars. In the finished creep tubing, remnant of Ti-rich secondary phase particles could also be found although the inhomogeneity is less pronounced than in the feedstock. A homogenization treatment (e.g., annealing at 1200°C for 2 h) may remove the banded structure and this will be tested on small pieces of the 832665 and 832664 bars in the near future.

Exploratory experiments were performed to evaluate the effect of oxygen on the crack growth response of V-4Cr-4Ti at 600°C under constant load. Tests were run in gettered argon, argon containing 2000 ppm oxygen, and laboratory air using fatigue pre-cracked compact tension specimens. Crack growth was measured primarily by post-test fracture surface examination, but also by in-test compliance measurements. Crack growth rates measured in air and getterd argon were about 2-3 $\times 10^{-3}$ mm/h at a stress intensity factor of about 40 MPa$\sqrt{m}$. The crack growth rate in argon with 2000 ppm oxygen was about 7×10^{-2} mm/h at the same intensity level. The crack growth rates were very sensitive to the stress intensity factor. Over a limited range of stress intensity values the crack growth rate in argon plus 2000 ppm oxygen appears to be power-law dependent on stress intensity with an exponent of about 8.9. The fracture mode in air and gettered argon was transgranular cleavage with 20 to 30% intergranular fracture. In the oxygenated argon environment crack growth occurred predominantly by transgranular cleavage.

To complement previous work on V-4Cr-4Ti at 400-500°C, similar oxidation experiments were conducted at 600-700°C. In general, the rates were linear with time. However, at higher oxygen pressures, e.g. 10^{-3} Pa (10^{-5} Torr), specimen surfaces became slightly discolored indicating the formation of a surface oxide and rates were linear-parabolic. The addition of more than 1000 ppm oxygen resulted in

More resistance weld samples were prepared on 3.8 mm thick V-4Cr-4Ti alloy plate on a 50 KVA welder with more optimal process parameters. The microstructure of the weld regions were characterized and correlated with the weld parameters. Simplified torque tests were conducted on the test samples to provide a preliminary assessment of the shear strength and ductility of the test welds. Fractography results for the torque samples indicated that the fracture surfaces of resistance welds exhibit ductile characteristics.

A systematic study is currently being conducted by Argonne National Laboratory with support from REB Research to provide baseline data on the solubility of hydrogen in selected LiCa, SnLi, and VCrTi alloys. The experimental approach involves charging and degassing of vanadium alloys and vanadium alloy encapsulated LiCa and SnLi specimens to various hydrogen partial pressures while maintaining the system at constant temperature. With this procedure one avoids the problems associated with the rapid redistribution of hydrogen that is typically observed during cool-down of the specimens. Initial tests have been conducted on solid cylindrical specimens of a vanadium alloy. The liquid metal alloy will be contained in vanadium alloy capsules. Preliminary results for the V-4Cr-4Ti alloy (Heat #832665) are reported.

Pressurized-tube specimens made from V-4 wt.% Cr-4 wt.% Ti (832665 heat) thin-wall tubing were irradiated in the HFIR RB-12J experiment to study creep under neutron-damage conditions. The calculated dose for the specimens ranged from 5.5 to 6.0 dpa and the calculated irradiation temperatures ranged from 400 to 500°C. The results show the creep rate to be linearly dependent on stress. The 12J data, when combined with the previous ATR-A1 data set, indicate the creep rates could be significant even at moderate stress and dpa levels.

Postirradiation tensile tests at room temperature and 500°C were performed on V-(Cr,Fe)-Ti alloys specimens irradiated in the HFIR-12J experiment. The specimens were of the SSJ design with overall dimensions of 16.0 × 4.0 × 0.2 mm and gauge dimensions of 5.0 × 1.2 × 0.2 mm. The irradiation temperature was ≈500°C and the attained neutron damage was ≈6 dpa. Results from these tensile tests show all specimens retained respectable elongation and irradiation hardening was modest. The properties of the V-(3-5)Cr-(3-5)Ti alloys appears not to be strongly affected by

Several rod-shaped specimens with uniaxially packed fibers (Hi-Nicalon, Hi-Nicalon Type S, Tyranno SA, and Amoco K1100 types) and a pre-ceramic polymer matrix have been fabricated. By using appropriate analytic models, the bare fiber thermal conductivity (K_f) and the interface thermal conductance (h) will be determined as a function of temperature up to 1000°C before and after irradiation for samples cut from these rods. Initial results are: (1) for unirradiated Hi-Nicalon SiC fiber, K_f varied from 4.3 up to 5.9 W/mK for the 27-1000°C range, (2) for unirradiated K1100 graphite fiber, K_f varied from 576 down to 242 W/mK for the 27-1000°C range, and (3) h = 43 W/cm^{2}K at 27°C as a typical fiber/matrix interface conductance.

The fabrication of large or complex silicon carbide-fiber-reinforced silicon carbide (SiC/SiC) components for fusion energy systems requires a method to assemble smaller components that are limited in size by manufacturing constraints. Previous analysis indicates that silicon carbide should be considered as candidate joint materials. Two methods to obtain SiC joints rely on a reaction between silicon and carbon to produce silicon carbide. This report summarizes preliminary mechanical properties of joints formed by these two methods. The methods appear to provide similar mechanical properties. Both the test methods and materials are preliminary in

The tensile properties and room temperature electrical resistivity have been measured for pure copper and MAGT 0.2, GlidCop AL15 and GlidCop AL25 oxide dispersion strengthened copper alloys following irradiation in the spectrally tailored HFIR-MFE-200J and –400J irradiation capsules. The tensile measurements were performed at the irradiation temperature and at room temperature, at strain rates between $2x10^{-5}$ s^{-1} and 0.01 s^{-1}. Significant increases in the tensile strength were observed following irradiation at 200°C, accompanied by a reduction in uniform elongation. The irradiation at 400°C had only a slight effect on the tensile properties. A large increase in the electrical resistivity (attributable to solid solution transmutation products) was observed for both irradiation temperatures. The tensile strength showed a slight increase with increasing strain rate, in agreement with previous observations in copper. **SUMMARIZE MAIN RESULTS—change in resistivity, presence of flow localization/ loss of strain hardening capacity in 200°C specimens; mention microstructural results obtained in Risø.

The key thermophysical and mechanical properties for Ta-(8-10)%W alloys are summarized, including unirradiated temperature-dependent tensile properties, stress-rupture behavior, elastic constants, thermal conductivity, thermal expansion, specific heat, and ductile-to-brittle transition temperature. The estimated lower and upper temperatures limits for structural applications are 700 and 1000°C due to radiation hardening/embrittlement and thermal creep considerations, respectively, although there are very few fracture properties data for irradiated Ta alloys.

The requirements of this task are to complete the engineering designs of irradiation capsules in BOR-60. The specimen matrix will include sheet tensile specimens, Charpy impact specimens, TEM disks, and pressurized creep tubes. This experiment will not include DHCE samples. To better utilize the test volume and provide additional temperature options, it was decided to modify the experiment from a two-capsule to a three-capsule design. All capsules will be liquid-metal-