BRASKI

DOE/ET-0058/6

Alloy Development for Irradiation Performance

Quarterly Progress Report
For Period Ending June 30, 1979

U.S. Department of Energy
Assistant Secretary for Energy Technology
Office of Fusion Energy

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Elevated temperature fatigue crack growth dnta has been generated using an electrical potential technique of monitoring crack extension in miniature center-cracked-tension specimens. The technique produced reliable accurate results at 316 and 260°C when compared with dnta generated from conventionat compact tension specimens.

The design of an in-reactor fatigue machine capable of performing tension/tension cycling on a chain of center-cracked-tension specimens in the ORR is nearing completion. A tentative test matrix has been established using the Path A Reference Alloy, 20% cold work 316 stainless steel.

We have calculated the effect of a tantalum core piece in the ORR on the thermal neutron flux and displacement rate in an enclosed experimental capsule. The large thermal capture cross section of tantalum [about 2.0×10^{-27} m^2 (20 b)] reduces not only the thermal flux but also the displacement rate in the experimental capsule as a result of localized reduction in the number of fissions. This reduction in displacement rate can be partly offset by increasing the fuel loading in adjacent core pieces.

We have designed and drawn the two experiments ORR-MFE-4A and ORR-MFE-4B. The first experiment will contain specimens at 300 and 400°C, and the second will contain specimens at 500 and 600°C. Parts are being fabricated for a bench test of the experiment, and a gamma heat measuring experiment is awaiting irradiation.

Specimens of 20%-cold-worked type 316 stainless steel were irradiated in the High Flux Isotope Reactor (HFIR) to fluences of 0.85 to 1.9×10^{26} n/m^2, resulting in displacement levels of 7 to 15 dpa and helium contents of 250 to 860 at. ppm. Fully reversed strain controlled fatigue tests were performed with strain ranges of 0.40 to 2.0%. The specimens were irradiated and tested ut 430°C and tested in a vacuum at a pressure below 10^{-4} Pa. The fatigue life was reduced by factors of 3 to 10. We are studying fracture surfaces and will subsequently report the results.

The stainless-steel-clad vanadium-15% chromium alloy loop for studies of circulating liquid lithium has continued to operate through the third quarter of FY-1979. This 0.5-liter-capacity, forced circulation loop is being used in investigations of (1) the distribution of nonmetallic elements in lithium/refractory metal systems and (2) effects of a lithium environment on the mechanical properties of selected refractory metals. Exposure of zirconium foil to lithium at both 673 and 873 K resulted in significant pickup of nitrogen by the zirconium and a corresponding reduction of the nitrogen concentration in lithium.