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INTERIM REPORT

NRC Research and Technical
Assistance Report

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MONTHLY HIGHLIGHTS

May 1979

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NRC Research and Technical
Assistance Report

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Phenomenological Research

Long-term high-cycle-fatigue tests are continuing on Incoloy 800H and Hastelloy X specimens which were preaged in HTGR helium. No significant new data have been obtained during the last month. A new series of high-cycle tests was initiated on annealed 2 1/4Cr-1Mo steam generator material which had been preaged in HTGR helium at 538°C (1000°F) for 3000 hours prior to testing. The data indicate that the strength of this aged material is very close to that for unaged material tested in air.

In the program on fission product effects on the mechanical properties of metals a preliminary evaluation has been made on control specimens of 2 1/4Cr-1Mo, Type 304 stainless steel, Incoloy 800 and Hastelloy X to determine the effects of low partial pressures of oxygen without fission product species being present. A batch of specimens exposed for about 2000 hours at 800°C in an evacuated quartz capsule showed small crystalline products on the surfaces. It is not known whether these are due to recrystallization of the cold worked surface (through surface preparation) or due to oxidation from oxygen and water which degassed from the quartz. A second batch of specimens exposed under similar conditions but with 10^{-14} atmospheres of oxygen from a Ni/NiO buffer mixture showed important differences from the first batch. The crystalline products were much rarer and evidence of general oxidation was more pronounced. A detailed account of these observations will be given in the forthcoming quarterly progress report.

The experiment has continued on the oxidation and strength of prestressed PGX graphite in helium or in air. Several specimens were oxidized at 450°C in air until the oxidation rate was stabilized (2-5 percent burnoff). Then the specimens were removed from the furnace and stressed to 70-80 percent of estimated fracture stress. These stressed specimens showed no change in reaction rate in comparison with those before prestressing. An experiment similar to that for PGX graphite is being carried out for H451 graphite.

PGX and H451 graphite cylinders 3/4 inch by 1 1/2 inches are being oxidized at 450°C in air. The PGX graphite is exhibiting a reactivity which is two orders of magnitude greater than that of H451; this difference may be ascribed to the high levels of metal oxide impurities, e.g. Ca, V, in PGX graphite, which may effectively catalyze the O₂-graphite reaction just as Fe catalyzes attack of graphite by H₂O.

Analyses of equilibrium experiments from the HIL show that the carbon activity and equilibrium oxygen potential for the steel in the loop are not independent. A relationship between the two implies that the carburizing-decarburizing potential of typical HTGR gases cannot be estimated from available thermodynamic data.

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