INTERIM REPORT

Accession No._____

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Contract Program or Project Title: HTGR Safety Program

Subject of this Document: Monthly Highlights Letter for August 1979.

Type of Document: Monthly Highlights Letter

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Date of Document:

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for the
U.S. Department of Energy

Prepared for
U.S. Nuclear Regulatory Commission
Washington, D. C. 20555
Under Interagency Agreement EY-76-C-02-0016
NRC FIN No. A-3016

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INTERIM REPORT

MONTHLY HIGHLIGHTS
August 1979

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This work was performed under the auspices of the United States Nuclear Regulatory Commission.

The high cycle fatigue work on Incoloy 800H was continued this month with emphasis on metallographic evaluations of the nature of the corroded surfaces, and how these can affect fatigue strength. Samples which had been preaged in HTGR helium prior to testing in the same gas environment were sectioned and polished and examined with optical and scanning electron microscopes. It was found that for an aging time of 1500 hours at 760°C (1400°F) the strength is lowered when compared to samples aged for lesser and also greater times. It seems that after 1500 hours at this temperature large numbers of small recrystallized grains are formed at the surface as a result of the cold worked layer produced during specimen fabrication. This causes significant increases in the rate at which oxygen can penetrate along grain boundaries. The losses in fatigue strength, therefore, are closely connected with enhanced surface embrittlement due to the thicker oxide layers. This phenomenon will be discussed more fully in the forthcoming quarterly progress report.

Oxidation of 1 1/2 inch by 3 inch axial EL-1 PGX graphite specimens (Union Carbide log 2V4-1) at 900°C with 0.1% H_2O + 1.70% H_2 in He gave rise to compressive strength (σ_c) losses that were slightly higher than those observed for axial ML-2 specimens (UC log 29N6-2). However, the scatter band in σ_c for unoxidized specimens was so large that a study was initiated to determine its cause. Variables which have been considered include (a) tolerances in diameter, length, and parallelism of the cylinder faces, (b) the machining lathe, and (c) the strength testing apparatus. It has been learned that the strength testing apparatus previously used gives widely discordant values of σ_c. To alleviate this problem all future measurements of σ_c will be made with an apparatus in the Metallurgy and Materials Sciences Division.

Experiments have been done on the effect of compressive prestress on the oxidation rate of H451 graphite oxidized in air at a temperature between 500 and 550°C. Different from the results on PGX graphite a small amount of increase in reaction rate seemed to be observed for prestressed specimens. Efforts are being made to investigate the reproducibility of the results and water vapor oxidation of the graphite.

1474 329

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10/8/79

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1474 30