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An Investigation of
SCALING OF ZIRCONIUM AT ELEVATED TEMPERATURES

Quarterly Status Report No. 4
March 2 to June 2, 1954

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Conducted By
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In Cooperation With The
United States Atomic Energy Commission
Contract No. AT(11-1)-258

June 10, 1954

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SCALING OF ZIRCONIUM AT ELEVATED TEMPERATURES

Scaling in Controlled Atmosphere

✓ The scaling behavior of zirconium has been investigated in the temperature range 800 to 1000°C. From the results thus far obtained, it appears that zirconium scales at a somewhat lower rate in O₂ (760 mm Hg) than in air. /end

Materials and Procedure

The Westinghouse Grade I zirconium was cold rolled from 0.165 inch to .030 inch and specimens approximately .475 x .250 x .030 inch were sheared off from the rolled strip. The specimens were swabbed in a dilute sulfuric acid solution followed by water and acetone rinses to remove any oil film. They were then suspended in the pyrex tube above the furnace and the system was then evacuated to .05 μ . The purified O₂ was then let in until the pressure reached 760 mm Hg. The purification of O₂ was carried out by passing O₂ through a train first used by Gulbransen⁽¹⁾ which consisted of:

1. Ba(ClO₄) - To remove water vapor.
2. Platinized asbestos (5%) - To oxidize any combustible material.
3. Ascarite and Ba(ClO₄) - To remove the products of combustion and any acid constituent.
4. A dry ice-acetone cold trap to remove the last traces of moisture.

A short time was then allowed to let the O₂ reach furnace temperature and then the specimens were lowered in the furnace by means of the ground joint vacuum tight lowering mechanism. The scaling rate was evaluated by measuring the increase in length with time of the helical Ni-Span C spring.

Results and Discussion

The results of the scaling studies in O₂ are plotted in Fig. 1. Two specimens were oxidized at each temperature and from the curves it appears that the results are fairly reproducible, the scatter increasing with decrease in temperature. In general the scaling rate is lower in O₂ (760 mm Hg) than in air as the temperature is lowered.

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(1) Gulbransen, E. A., Trans. Electrochemical Soc. 81, 1942, p. 327.

The important characteristic of these curves is that they do not show any increase in the scaling rate as was experienced in air. Another interesting feature which is to be expected in view of the above results is that the specimens did not show any white scale for the times investigated.

Runs were also carried out at 700°C, but due to the great amount of scatter experienced it was decided to carry out further studies and report them at a later date.

The scaling behavior in nitrogen will be investigated next and the results will be reported at a future date.

FIG.11: WEIGHT INCREASE PER UNIT ORIGINAL AREA AS A FUNCTION OF TIME AND TEMPERATURE ($^{\circ}C$) IN O_2 (760mm Hg).

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