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Push-pull fatigue properties of wires

in an iridium - 5% tungsten alloy

- by -

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Introduction

This memorandum reports a series of tests to determine the fatigue properties of an iridium - 5% tungsten alloy at 600°C and 700°C.

A previous memorandum, Memo. Mat. 61, reports the fatigue properties at room temperature of the same alloy.

Experimental

The general arrangement of the apparatus is shown in Figure 1.

Drawn wire, 0.020" diameter was cut into 1.375" lengths using a diamond flexible cutting wheel. The specimens were held in specially designed Nimonic grips and fatigue cycles applied by a Goodman's electromagnetic vibrator mounted in a rigid steel frame. The frame also contained a 3 zone tube furnace.

The frequency used was 140 c.p.s. The vibrator was calibrated by rigidly attaching it to the frame of a 2 Ton Vibrophore fatigue machine with the vibrator output shaft coupled to the Vibrophore 0.4 Ton dynamometer.

Input current to the vibrator was plotted against load output from the dynamometer.

Spot calibration checks were carried out at regular intervals. No measurable deviation from the original calibration was detected.

Results

Tests have been completed at 600°C and at 700°C and the results are shown tabulated in figures 2 and 3 and plotted to a base of log time in figure 5.

Additional tests were carried out at room temperature in order to define the S.N. curve more fully at the lower stress levels, as reported in Mat. Memo No. 61.

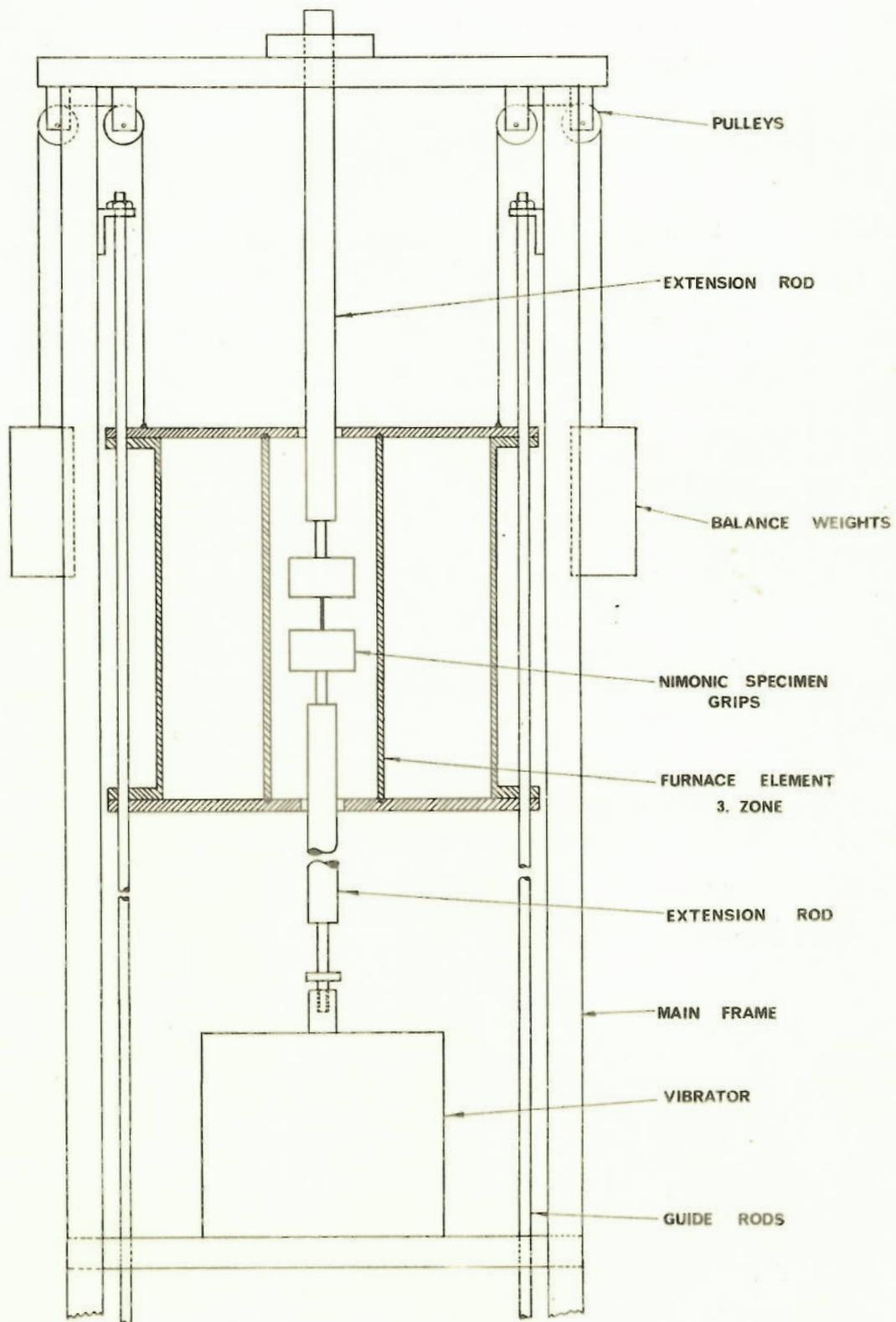


FIGURE 1 GENERAL ARRANGEMENT OF APPARATUS

Figure 2

Fatigue lives of 0.020" diameter wire, iridium - 5% tungsten alloy at 600°C.

Stress level ± t.s.i.	Cycles to failure
28.4	5.6×10^7
31.25	1.1×10^7 , 3×10^6 , 3.63×10^7
34.1	3.8×10^6 , 6×10^6
36.9	1.3×10^7 , 1.5×10^6
39.8	4.53×10^7 , 2.1×10^5 , 3.1×10^5
42.6	1.3×10^5 , 5.1×10^4 , 1.1×10^6
45.5	1×10^5 , 8.4×10^4 , 3.4×10^4 , 3.5×10^5
51.2	3.4×10^4 , 1.7×10^5 , 1.5×10^5 , 7.9×10^4
56.8	2.5×10^4 , 1.9×10^4 , 4.2×10^3 , 2.5×10^4
63.9	8.4×10^3 , 1.7×10^4 , 6.3×10^3
71.0	2.8×10^3 , 2.4×10^3

Figure 3

Fatigue lives of 0.020" diameter wire, iridium - 5% tungsten alloy at 700°C.

Stress level ± t.s.i.	Cycles to failure
28.4	8 x 10 ⁷ unbroken
29.8	1.16 x 10 ⁷ , 1.92 x 10 ⁷
31.25	5.9 x 10 ⁵ , 1.66 x 10 ⁷ , 2.32 x 10 ⁷
32.6	1.19 x 10 ⁵
34.1	2.88 x 10 ⁵ , 5.8 x 10 ⁵
36.9	9.2 x 10 ⁴ , 6.7 x 10 ⁴
45.5	7.6 x 10 ⁴ , 1.28 x 10 ⁴
63.9	4.2 x 10 ²



Figure 4

Additional tests of fatigue lives of 0.020" diameter wire, iridium - 5% tungsten alloy at room temperature.

Stress level ± t.s.i.	Cycles to failure
34.1	2.32 x 10 ⁷
36.9	3.5 x 10 ⁶
46.1	2.52 x 10 ⁵
56.8	2.1 x 10 ⁴
71.0	1.68 x 10 ⁴ , 2.11 x 10 ³
	Results below carried out on Vibrophone at 70 c.p.s.
45.4	6.8 x 10 ⁶
56.8	3.74 x 10 ⁵ , 1.36 x 10 ⁵
71.0	2.5 x 10 ⁴

S/N CURVE FOR IRIIDIUM 5% TUNGSTEN ALLOY WIRE AT
600 AND 700°C IN TENSION--COMPRESSION

DIAMETER 0.020 IN.
GAUGE LENGTH 0.187 IN.

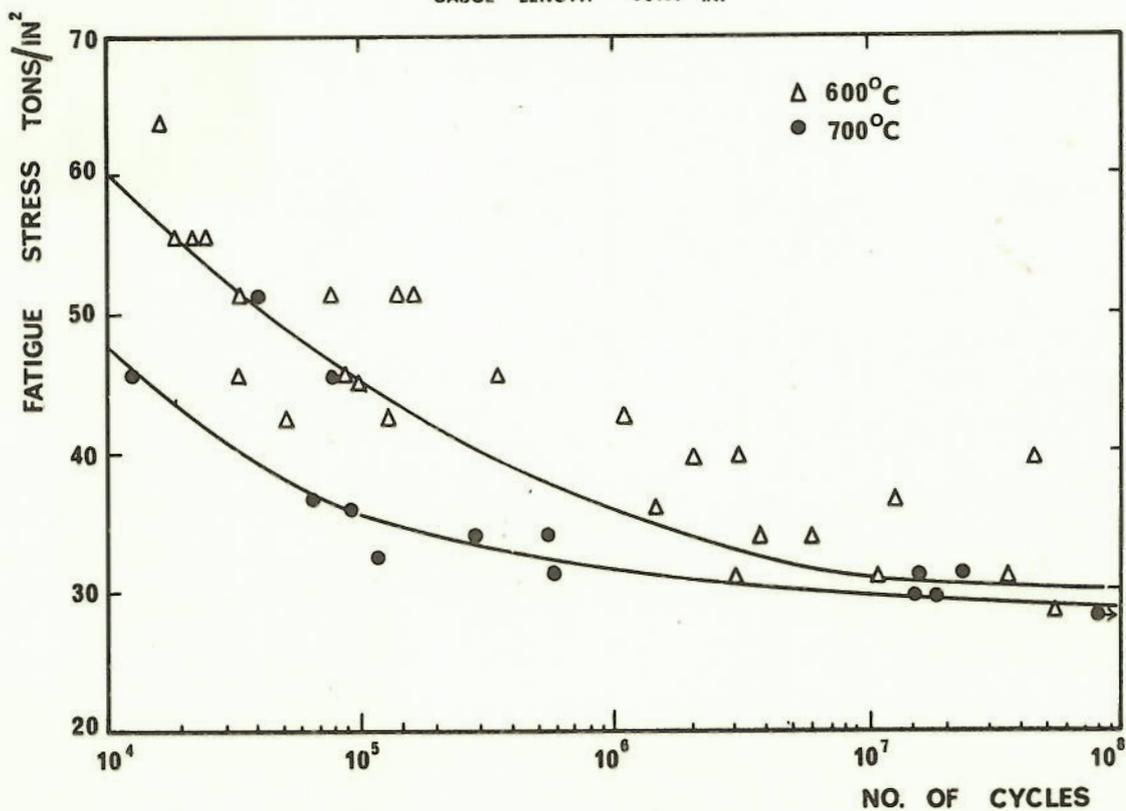


FIGURE 5