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DEPARTMENT OF MINES AND RESOURCES

BUREAU OF MINES

CANADA

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Ottawa, November 5, 1946.

R E P O R T

of the

ORE DRESSING AND METALLURGICAL LABORATORIES.

Investigation No. 2133.

Fatigue Properties of Four "As Cast" Magnesium  
Alloys (AZ90X, AZ91X, AZ80X, and AZ63X).

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Introduction:

In a previous investigation (see Investigation Report No. 2039, dated April 29, 1946), the fatigue strength of three magnesium alloys, AZ92X, AZ80X and AZ63X, was determined at  $10^7$  reversals.

In the present work, however, the fatigue strength of the magnesium alloys investigated was determined at  $10^8$  reversals. All values given in this report were determined on Moore High Speed Rotating Beam Fatigue Testing Machines operated at approximately 10,000 r.p.m.

The magnesium metal used in these tests was produced by the 'Ferrosilicon' process in the plant of Dominion Magnesium Limited at Haley, Ontario.

Chemical Composition:

The four alloys used in this investigation had the following chemical composition:

TABLE I.

Alloy Symbol:	Melt: JJ	Analysis, in Per Cent							
		Chemical				Spectrographic			
		Al	Zn	Mn	Fe	Si	Pb	Cu	Mg
AZ92X	JJ	9.17	2.08	0.38	0.001	0.010	0.004	0.001	Balance
AZ91X	JK	9.56	0.43	0.59	0.003	0.013	0.004	0.002	"
AZ80X	JH	8.45	0.40	0.39	0.001	0.011	0.004	0.003	"
AZ63X	JI	5.88	3.12	0.33	0.002	0.020	0.004	0.0015	"

Rotating Bending Fatigue Tests:

The test specimens used were standard Moore fatigue test pieces. The specimens were first given a smooth machine finish and then polished longitudinally with 00 emery paper. The alloys were then tested to  $10^8$  cycles. The results on four "as cast" magnesium alloys are given in Table II. S-N fatigue curves of these alloys are shown in the chart, Figure 1, on Page 3.

(Figure 1 comprises Page 3.)  
(Table II follows on Page 4.)

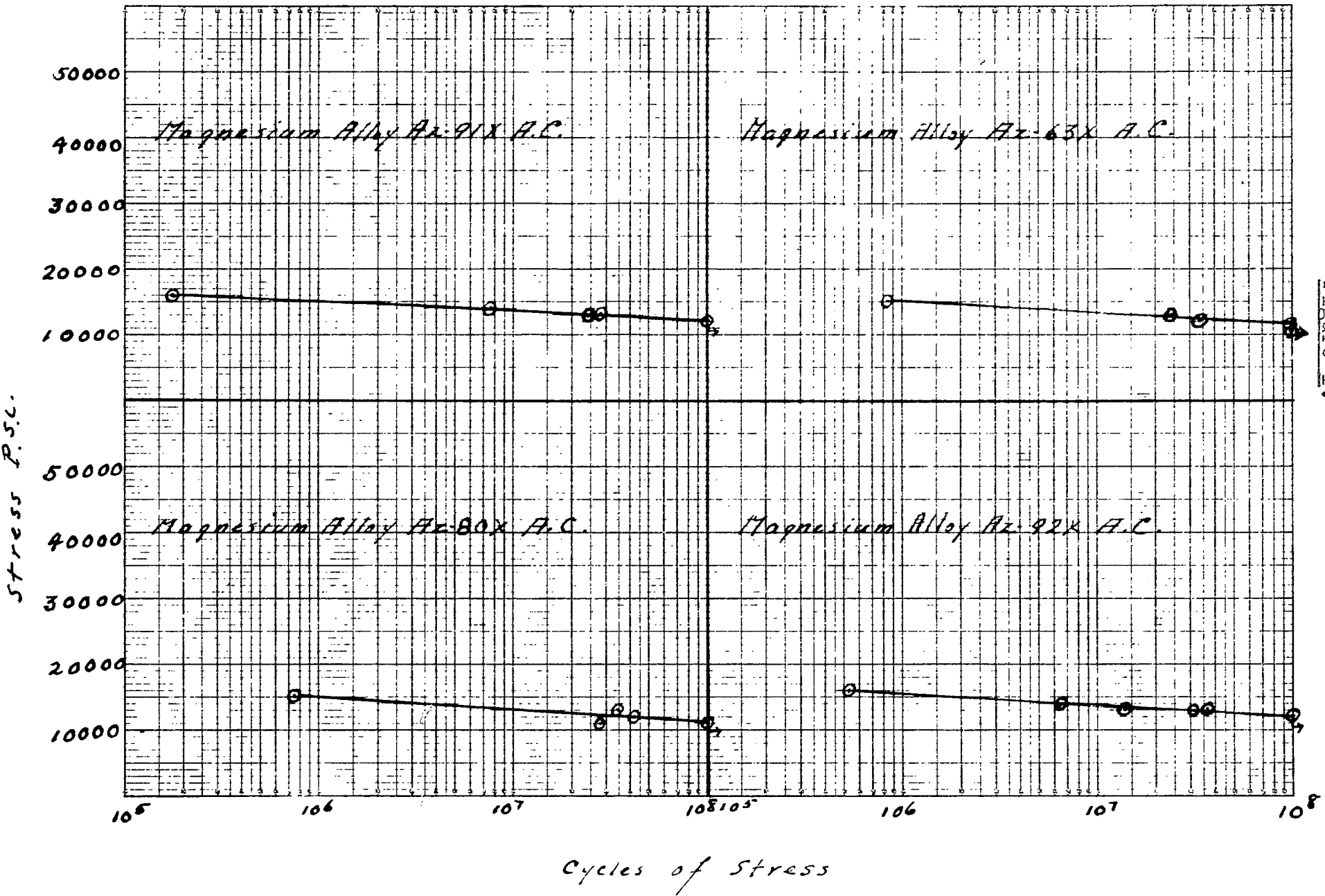


Figure 1.

(Rotating Bending Fatigue Tests, cont'd) -

TABLE II.

<u>Alloy Symbol</u>	<u>Specimen Number</u>	<u>Applied Load, pounds</u>	<u>Applied Stress, p.s.i.</u>	<u>Number of Reversals</u>	<u>Remarks</u>
AZ92X	JJ-15	11.2	16,000	528,000	Broke.
	14	8.7	14,000	6,460,000	"
	11	7.4	13,000	13,881,000	"
	13	7.4	13,000	36,641,000	"
	17	7.4	13,000	32,488,000	"
	18	6.5	12,500	10 <sup>8</sup>	No break.
	12	5.9	12,000	10 <sup>8</sup>	" "
AZ91X	JK-14	11.2	16,000	165,000	Broke.
	12	8.7	14,000	7,750,000	"
	11	7.4	13,000	28,276,000	"
	15	7.4	13,000	24,908,000	"
	16	6.5	12,500	10 <sup>8</sup>	No break.
	13	5.9	12,000	10 <sup>8</sup>	" "
AZ80X	JH-41	10.2	15,000	744,000	Broke.
	42	7.4	13,000	34,959,000	"
	43	7.4	13,000	7,655,000	"
	48	6.1	12,000	8,140,000	"
	44	6.1	12,000	40,835,000	"
	45	4.7	11,000	4,703,000	"
	46	4.7	11,000	27,880,000	"
	47	4.7	11,000	10 <sup>8</sup>	No break.
AZ63X	JI-41	10.2	15,000	843,000	Broke.
	42	7.4	14,000	24,067,000	"
	44	6.1	12,000	2,930,000	"
	45	6.1	12,000	33,927,000	"
	46	5.3	11,500	10 <sup>8</sup>	No break.
	43	4.9	11,000	10 <sup>8</sup>	" "

Summary:

The fatigue strengths, in pounds per square inch at one hundred million reversals, of the four "as cast" alloys investigated are shown in Table III, together with values published<sup>6</sup> by Dow Chemical Company for AZ92X and AZ63X alloys.

(Table III appears)  
( on Page 5. )

<sup>6</sup>

In "The American Foundryman," A.F.A. Official Magazine, October 1945, page 42, table 2.

(Summary, cont'd) -

TABLE III.

<u>Laboratory</u>	<u>Alloy</u>	<u>Heat Treatment</u>	<u>Endurance Limit at 10<sup>8</sup> Reversals, p.s.i.</u>
B. of M.	92X	A.C.	12,500
Dow	"	"	13,000
B. of M.	91X	"	12,500
B. of M.	80X	"	11,000
B. of M.	63X	"	11,500
Dow	"	"	10,000

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Remarks:

An examination of the test results given in Table II shows a considerable scatter. However, it will be noted that the fatigue values of the alloys produced in these Laboratories are equal, and in some cases superior, to values reported for similar magnesium alloys produced by Dow Chemical Company.

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