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Div 18

NATIONAL DEFENSE RESEARCH COMMITTEE

of

OFFICE OF SCIENTIFIC RESEARCH AND DEVELOPMENT

WAR METALLURGY DIVISION

Air Documents Division, T-2
AMC, Wright Field
Microfilm No.
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Advisory Report

on

INDEXING OF DIVISION 18 NDRC REPORTS: REPORTS ON MAGNESIUM ALLOYS

by

HELEN L. PURDUM
RESEARCH INFORMATION DIVISION
WAR METALLURGY COMMITTEE

OSRD No. 6667
Serial No. M-663
Copy No. 29

June 15, 1946

June 15, 1946

To: Dr. James B. Conant, Chairman
National Defense Research Committee of the
Office of Scientific Research and Development

From: War Metallurgy Division (Div. 18), NDRC

Subject: Advisory Report on "Indexing of Division 18,
NDRC Reports: Reports on Magnesium Alloys"

The attached advisory report was prepared by the Research Information Division of the War Metallurgy Committee and has been approved by representatives of the Committee.

It is believed that this index will prove valuable to the Armed Services as a guide to the reports on Magnesium Alloys issued by Division 18, NDRC.

I recommend acceptance as a satisfactory advisory report from the War Metallurgy Committee under the provisions of Contract OEMsr-307 between the Office of Scientific Research and Development and the National Academy of Sciences.

Respectfully submitted,

Clyde Williams

Clyde Williams, Chief
War Metallurgy Division, NDRC

Enclosure

PREFACE

The distribution of this report is as follows:

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Index Prepared by:

Helen Purdum, Librarian
Research Information Division
War Metallurgy Committee

June 15, 1946

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Designation of Alloy Symbols

Magnesium alloy compositions have been indexed under Dowmetal symbols only, even though the reports indexed contain the results of experimental work on both AMC (American Magnesium Corporation) and Dowmetal Alloys. This indexing procedure brings together under one heading all information on alloys of identical or nearly identical composition. Some of the reports also refer to magnesium alloys by AMS (Aeronautical Material Specifications) and SAE (Society of Automotive Engineers) specification symbols. A table of approximate equivalence, including these four groups of symbols, appears at the end of the Subject Index.

Some of the reports on magnesium alloys include information on aluminum alloys. This information has been indexed under the Alcoa (Aluminum Company of America) symbols.

SUBJECT LIST OF PROJECTS WITH REPORT NUMBERS

Magnesium alloys

Deformation Characteristics NRC-70	Deformation Characteristics of Magnesium Alloys. M-150, M-189, M-213, M-214, M-276, M-341, M-354, M-454.
Fatigue Properties NRC-22	Fatigue Properties of Magnesium Alloys. M-36, M-76, M-125, M-169, M-213, M-289, M-354, M-381.
Formability NRC-44	Formability of Magnesium Alloy Sheet. M-65, M-110, M-151, M-170, M-210, M-213, M-274, M-313, M-330, M-353, M-354.
Heat Treatment see Properties and Heat Treatment	
High Temperature SP-15	High Temperature Properties of Light Alloys. M-292.
Physical and Stress Corrosion Properties NRC-67	Physical and Stress Corrosion Properties of Magnesium Alloy Sheet. M-152, M-197, M-213, M-237, M-471, M-647.
Properties and Heat Treatment NRC-21	Properties and Heat Treatment of Magnesium Alloys. M-28, M-50, M-103, M-104, M-105, M-106, M-129, M-177, M-213, M-354.
Stress Corrosion Properties see Physical and Stress Corrosion Properties	
Research, Survey of Current SP-26	Survey of Current Research on Magnesium and Magnesium Alloys Being Conducted in the U. S. M-553, M-652.

NUMERICAL LIST OF REPORTS

Serial M-28
OSRD 1099

Progress Report on Properties and Heat Treatment of Magnesium Alloys, by John E. Dorn. Dec. 11, 1942.

Project No. NRC-21 (Contract OEMsr-647, University of California).

Preliminary investigation of the physical properties and heat treatment of magnesium alloys.

Serial M-36
OSRD 1146

Progress Report on Fatigue Properties of Magnesium Alloys and Structures: Fatigue Properties of Magnesium Alloy Sheet, by H. W. Russell. Jan. 19, 1943.

Project No. NRC-22 (Contract OEMsr-729, Battelle Memorial Institute)

Discusses the development of testing techniques for magnesium alloy sheet, including a description of test results on Dow Metal J Sheet.

Serial M-50
OSRD 1291

Progress Report on Properties and Heat Treatment of Magnesium Alloys, by John E. Dorn. March 10, 1943.

Project No. NRC-21 (Contract OEMsr-647, University of California)

Investigations on (1) the effect of specimen size upon determination of tensile properties, (2) notch sensitivity, (3) damping capacity, and (4) the influence of heat treatment on tensile properties.

Serial M-65
OSRD 1485

Progress Report on Formability of Magnesium Alloy Sheet, by John E. Dorn. May 21, 1943.

Project No. NRC-44 (Contract OEMsr-839, University of California)

A description of the test equipment and test schedules which are to be used, and consideration of the use of data which are to be determined.

NUMERICAL LIST OF REPORTS

Serial M-110
OSRD 1791

Progress Report on Formability of Magnesium Alloy Sheet, by John E. Dorn and A. C. Ballaseyus. Sept. 1, 1943

Project No. NRC-44 (Contract OEMsr-839, University of California)

Covers the tensile testing of Dowmetal J-1a and J-1h sheet 0.064 inches thick under various conditions of temperature and strain rate.

Serial M-125
OSRD 1858

Progress Report on Fatigue Properties of Magnesium Alloys and Structures: Fatigue Properties of Magnesium Alloy Sheet, by H. W. Russell. Sept. 27, 1943.

Project No. NRC-22 (Contract OEMsr-729, Battelle Memorial Institute)

Data on the fatigue strength of J and M magnesium alloy sheet and a fatigue study of riveted, spot-welded, Cyclewelded, and Heliarc-welded joints.

Serial M-129
OSRD 1950

Progress Report on Properties and Heat Treatment of Magnesium Alloys, by J. E. Dorn, E. G. Thomsen, and I. Cornet. Oct. 14, 1943.

Project No. NRC-21 (Contract OEMsr-647, University of California)

A continuation of the experimental work on the notch sensitivity of magnesium alloys.

Serial M-150
OSRD 2076

Progress Report on Deformation Characteristics of Magnesium Alloys, by C. S. Barrett, F. N. Rhines, and C. T. Haller, Nov. 15, 1943.

Project No. NRC-70 (Contract OEMsr-1083, Carnegie Institute of Technology)

Results to date of investigations on the effects of bending, straightening, compressing, cold rolling and recrystallization on the preferred orientation of magnesium sheet, as well as a study of the cracks resulting from tensile loading and bending.

NUMERICAL LIST OF REPORTS

Serial M-76
OSRD 1457

Progress Report on Fatigue Properties of Magnesium Alloys and Structures: Fatigue Properties of Magnesium Alloy Sheet, by H. W. Russell: May 17, 1943.

Project No. NRC-22 (Contract OEMsr-729, Battelle Memorial Institute)

Investigations on the fatigue strength of four different magnesium alloys of various sheet widths and thicknesses, and of riveted, Cycle welded, and spot welded joints.

Serial M-103
OSRD 1818

Final Report on Properties and Heat Treatment of Magnesium Alloys: Part I - The Effect of Size Upon Tensile Properties of Specimens of Magnesium Alloy Sheet, by John E. Dorn and Dan M. Finch. Sept. 3, 1943.

Project No. NRC-21 (Contract OEMsr-647, University of California)

A study of the effect of size on the tensile properties of four magnesium alloys.

Serial M-104
OSRD 1819

Final Report on Properties and Heat Treatment of Magnesium Alloys: Part II - Notch Sensitivity of Magnesium Alloys, by John E. Dorn and J. L. Meriam. Sept. 3, 1943.

Project No. NRC-21 (Contract OEMsr-647, University of California)

Presents an initial evaluation of the notch sensitivity of magnesium alloys.

Serial M-105
OSRD 1820

Final Report on Properties and Heat Treatment of Magnesium Alloys: Part III - Damping Capacity of Magnesium Alloys, by John E. Dorn and Julius J. Jelinek. Sept. 3, 1943

Project No. NRC-21 (Contract OEMsr-647, University of California)

Investigations on the damping capacities of three magnesium-base extrusions, nine magnesium-base sand castings, and seven aluminum-base sand and permanent mold castings.

Serial M-106
OSRD 1821

Final Report on Properties and Heat Treatment of Magnesium Alloys: Part IV - Heat Treatment of Magnesium Alloys, by John E. Dorn, Israel I. Cornet, Alan E. Flanigan and Ralph Hultgren. Sept. 3, 1943.

Project No. NRC-21 (Contract OEMsr-647, University of California)

Studies of the solution heat treatment and aging of AMS 4434 (Dowmetal C) magnesium casting alloys.

NUMERICAL LIST OF REPORTS

Serial M-151
OSRD 2062

Final Report on Formability of Magnesium Alloy Sheet: Part I - Elevated Temperature Variable Speed Tensile Tests on Magnesium Alloys, by J. E. Dorn and A. C. Ballaseyus. Nov. 19, 1943.

Project No. NRC-44 (Contract OEMsr-839, University of California)

This report consists of numerous graphs and charts which give tensile data as functions of temperature and speed.

Serial M-152
OSRD 2063

Progress Report on Physical and Stress Corrosion Properties of Magnesium Alloy Sheet, by M. A. Hunter. Nov. 25, 1943.

Project No. NRC-67 (Contract OEMsr-1033, Rensselaer Polytechnic Institute)

Investigations on the optimum conditions for short time testing of the stress-corrosion cracking of magnesium alloy sheet. Data on the correlation of microstructure with the susceptibility to stress-corrosion cracking is also included.

Serial M-169
OSRD 3033

Final Report on Fatigue Properties of Magnesium Alloys and Structures: Fatigue Properties of Magnesium Alloy Sheet-Part I, by L. R. Jackson, H. J. Grover, W. W. Beaver, and H. W. Russell. Dec. 23, 1943.

Project No. NRC-22 (Contract OEMsr-729, Battelle Memorial Institute)

Summarizes test results reported in previous progress reports, together with some additional data, and presents general conclusions from tests on (1) monoblock samples of sheet, (2) samples notched by drilled rivet holes, and (3) jointed samples.

Serial M-170
OSRD 2079

Final Report on Formability of Magnesium Alloy Sheet: Part II - Forming of Bends on the Guerin Press, by J. E. Dorn, J. J. Jelinek, and A. C. Ballaseyus. Nov. 26, 1943.

Project No. NRC-44 (Contract OEMsr-839, University of California)

Presents die and part design data relative to the permissible limits of forming bends and to the spring-back for bending the current standard magnesium alloy sheets for temperatures of 70°F to 450°F.

NUMERICAL LIST OF REPORTS

Serial M-177
OSRD 3043

Final Report on Properties and Heat Treatment of Magnesium Alloys: Part V - Section I - The Sensitivity of Magnesium Alloy Sheet to Drilled, Reamed, and Punched Holes by J. E. Dorn and E. G. Thomsen, Section II - The Notch Sensitivity of Magnesium Alloy Extrusions and the Influence of Various Factors by J. E. Dorn and I. Cornet. Dec. 20, 1943.

Project No. NRC-21 (Contract OEMsr-647, University of California)

Investigations of the effect of (1) circular holes in test coupons, and (2) artificially produced scratches on the tensile strength of magnesium alloy sheet.

Serial M-189
OSRD 3016

Progress Report on Deformation Characteristics of Magnesium Alloys: Metallography of Commercial Magnesium Sheet, by C. S. Barrett, F. N. Rhines, and C. T. Haller. Dec. 9, 1943.

Project No. NRC-70 (Contract OEMsr-1083, Carnegie Institute of Technology).

Discusses an etching solution which has proven satisfactory for developing the structure of twins and revealing precipitates in magnesium sheet of 3% and of 6% aluminum composition.

Serial M-197
OSRD 3175

Progress Report on Physical and Stress Corrosion Properties of Magnesium Alloy Sheet, by M. A. Hunter. Jan. 14, 1944.

Project No. NRC-67 (Contract OEMsr-1033, Rensselaer Polytechnic Institute)

Covers further stress-corrosion cracking tests of magnesium alloy sheet, giving data on stress-corrosion in various heat treated alloys. Additional data are given on the effect of pH of corroding solutions on cracking times in heat treated sheets.

Serial M-210
OSRD 3350

Final Report on Formability of Magnesium Alloy Sheet: Part III - Evaluation of the Deep Drawing Properties of Magnesium Alloys at Elevated Temperatures, by J. E. Dorn, D. M. Finch, and J. J. Jelinek. March 8, 1944.

Project No. NRC-44 (Contract OEMsr-839, University of California)

A discussion of the optimum forming conditions for the deep drawing magnesium alloys, giving details on the effects of die and punch design as well as the influence of other factors on drawability.

NUMERICAL LIST OF REPORTS

Serial M-213
OSRD 3218

Advisory Report on The Effect of Combined Stresses on the Ductility of Metals, by J. E. Dorn and E. G. Thomson. Feb. 2, 1944.

(War Metallurgy Committee)

Reviews the existing knowledge of the effect of combined stress on the ductility of metals, and presents a method of calculating the permanent strains at fracture under combined stresses.

Serial M-214
OSRD 3272

Progress Report on Deformation Characteristics of Magnesium Alloys, by C. S. Barrett, F. N. Rhines, and C. T. Hallor. Feb. 14, 1944.

Project No. NRC-70 (Contract OEMsr-1083, Carnegie Institute of Technology)

Studies of (1) intercrystalline and trans-crystalline fractures in pure cast magnesium and (2) twinning in magnesium alloy sheet.

Serial M-237
OSRD 3477

Progress Report on Physical and Stress Corrosion Properties of Magnesium Alloy Sheet, by M. A. Hunter. April 6, 1944.

Project No. NRC-67 (Contract OEMsr-1033, Rensselaer Polytechnic Institute)

Additional information on the effects of heat treatment on the physical and stress corrosion properties of magnesium alloy sheet.

Serial M-274
OSRD 3791

Final Report on Formability of Magnesium Alloy Sheet: Part IV - Forming Stretch Flanges in the Guerin Press, by John E. Dorn and Erich G. Thomsen. June 5, 1944.

Project No. NRC-44 (Contract OEMsr-839, University of California)

Presents data which define the limits of stretch formability and provide a guide for the design and fabrication of stretch flanges of magnesium alloys.

NUMERICAL LIST OF REPORTS

Serial M-276
OSRD 3713

Progress Report on Deformation Characteristics of Magnesium Alloys, by C. S. Barrett, F. N. Rhines, and C. T. Haller. May 22, 1944.

Project No. NRC-70 (Contract OEMsr-1083, Carnegie Institute of Technology)

Studies of twinning in magnesium alloy sheet, of preferred orientation in extruded magnesium slabs, and of intercrystalline and trans-crystalline fractures in pure cast magnesium.

Serial M-289
OSRD 3792

Final Report on Fatigue Properties of Magnesium Alloys and Structures: Fatigue Properties of Magnesium Alloy Sheet - Part II, by L. R. Jackson, H. J. Grover, W. W. Beaver, and H. W. Russell. June 12, 1944.

Project No. NRC-22 (Contract OEMsr-729, Battelle Memorial Institute)

Results of fatigue studies of FS-1 sheet, corrosion fatigue studies of FS-1 in salt solutions, and preliminary fatigue studies of FS-1-h and J-1h sheet after precipitation heat treatment.

Serial M-292
OSRD 4150

Final Report on High Temperature Properties of Light Alloys: Part II - Magnesium, by L. L. Wyman. Sept. 18, 1944.

Survey Project No. SP-15 (Contract OEMsr-307, National Academy of Sciences)

Serial M-313
OSRD 3940

Final Report on Formability of Magnesium Alloy Sheet: Part V - Forming Shrink Flanges in the Guerin Press, by John E. Dorn, Erich G. Thomsen, and Don Cunningham. July 14, 1944.

Project No. NRC-44 (Contract OEMsr-839, University of California)

Presents data on the limits of shrink formability and provides basic information necessary for the design and fabrication of shrink flanges of magnesium alloys.

NUMERICAL LIST OF REPORTS

Serial M-330
OSRD 4042

Final Report on Formability of Magnesium Alloy Sheet: Part VI - Forming Beads on the Guerin Press, by Erich G. Thomsen, Don Cunningham, and John E. Dorn. Aug. 10, 1944.

Project No. NRC-44 (Contract OEMsr-839, University of California)

Presents data for the design and tooling of internal beads for six magnesium alloys at temperatures up to 450°F.

Serial M-341
OSRD 4070

Progress Report on Deformation Characteristics of Magnesium Alloys, by C. S. Barrett, F. N. Rhines, C. T. Haller, and B. H. Alexander. Aug. 10, 1944.

Project No. NRC-70 (Contract OEMsr-1083, Carnegie Institute of Technology)

Studies of the effect of deformation and heat treatment on the crystalline structure of magnesium alloys.

Serial M-353
OSRD 4171

Final Report on Formability of Magnesium Alloy Sheet: Part VII - Stretch Forming Magnesium Alloys, by D. M. Finch, I. G. Lotze, and J. E. Dorn. Sept. 20, 1944.

Project No. NRC-44 (Contract OEMsr-839, University of California)

Results of investigations on the stretch forming properties of magnesium alloys at elevated temperatures.

Serial M-354
OSRD 4172

Advisory Report on Stress-Strain Relationships for J_1 Magnesium Alloy Extrusion under Biaxial Stresses, by D. M. Cunningham, E. G. Thomsen, and J. E. Dorn. Sept. 20, 1944.

(War Metallurgy Committee)

A study of some of the fundamental assumptions of the theory of plastic flow under combined stresses by means of tests on J_1 magnesium alloy extrusions.

NUMERICAL LIST OF REPORTS

Serial M-381
OSRD 4282

Final Report on Fatigue Properties of Magnesium Alloys and Structures: Fatigue Properties of Magnesium Alloy Sheet - Part III, by L. R. Jackson, H. J. Grover, W. A. Beaver, and H. W. Russell. Oct. 20, 1944.

Project No. NRC-22 (Contract OEMsr-729, Battelle Memorial Institute)

Results of a study of the corrosion fatigue strength of magnesium sheet alloys. Some miscellaneous items, completing work described in previous reports, are also discussed.

Serial M-454
OSRD 4653

Final Report on Deformation Characteristics of Magnesium Alloys, by C. S. Barrett, F. N. Rhines, C. T. Haller, and B. H. Alexander. Jan. 29, 1945.

Project No. NRC-70 (Contract OEMsr-1083, Carnegie Institute of Technology)

Results of an investigation of the effects of deformation and heat treatment on the crystal structures of magnesium alloys.

Serial M-471
OSRD 4824

Progress Report on Physical and Stress Corrosion Properties of Magnesium Alloy Sheet, by M. A. Hunter, A. Jones, R. H. Trathen, S. Mackay, J. M. Parks and J. F. Throop. March 17, 1945.

Project No. NRC-67 (Contract OEMsr-1033, Rensselaer Polytechnic Institute)

Investigations of the effects of certain variables on the physical and stress corrosion properties of magnesium alloy sheet. The principal variables considered were heat treatments and procedures and temperatures of rolling.

Serial M-553
OSRD 5400

Advisory Report on A Survey of Research on Magnesium and Magnesium Alloys Being Conducted by Government Agencies, Branches of the Armed Services, and Producers and Fabricators of Magnesium, by J. C. De Haven. Aug. 3, 1945.

Survey Project No. SP-26 (Contract OEMsr-307, National Academy of Sciences)

A survey of current research being conducted on magnesium and magnesium alloys.

NUMERICAL LIST OF REPORTS

Serial M-647
OSRD 6596

Final Report on Physical and Stress Corrosion Properties of Magnesium Alloy Sheet, by M. A. Hunter, A. Jones, S. Mackay, R. H. Trathen, J. M. Parks, and J. F. Throop. Feb. 7, 1946.

Project No. NRC-67 (Contract OEMsr-1033, Rensselaer Polytechnic Institute)

Summarizes the results of investigations of the physical and stress corrosion properties of magnesium alloy sheet, and discusses new methods of procedure and heat treatments undertaken in an attempt to improve the properties.

Serial M-652
OSRD 6599

Advisory Report on "Suggested Research Topics on Magnesium and Magnesium Alloys", by the War Metallurgy Committee. Feb. 25, 1946.

Survey Project No. SP-26 (Contract OEMsr-307, National Academy of Sciences)

This report reviews a previous report (M-553) pointing out where additional research might be warranted, and where the scope of existing research projects might be expanded advantageously.

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Survey of research being conducted by government agencies, branches of the armed services, and producers and fabricators of magnesium M-553

MAGNESIUM ALLOY SYMBOLS AND COMPOSITIONS*

Magnesium alloy compositions have been indexed under Dowmetal symbols only, even though the reports indexed contain the results of experimental work on both AMC (American Magnesium Corporation) and Dowmetal Alloys. This indexing procedure brings together under one heading all information on alloys of identical or nearly identical composition. Some of the reports also refer to magnesium alloys by AMS (Aeronautical Material Specifications) and SAE (Society of Automotive Engineers) specification symbols.

Symbols				Nominal composition (percent) Remainder Mg.		
Dowmetal	AMC	AMS	SAE	Al	Mn	Zn
C	260	4434	500	9.0	0.1	2.0
Fs	52S		52	2.8	0.3	1.0
Fs-1-a	52S-O			2.8	0.3	1.0
Fs-1-h	52S-H			2.8	0.3	1.0
Fs-a				2.7	0.3	1.0
Fs-H				2.7	0.3	1.0
H	265	4420	50	6.0	0.2	3.0
J	57S		520	6.5	0.2	0.7
J-1	57S			6.5	0.2	0.7
J-1-a	57S-O	4380		6.5	0.2	0.7
J-1-h	57S-H	4381		6.5	0.2	0.7
M	3S				1.5	
Ma	3SO	4370a	51		1.5	
Mh	3S-H	4370h	51		1.5	
O	58S			8.5	0.2	0.5
O-1				8.5	0.2	0.5
R	263	4490	501	9.0	0.2	0.6
X	74S			3.0	0.2	3.0

* Experimental alloys tested in reports M-152, M-237, M-292, M-471 and M-647 are not included in this table.

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ABSTRACT

An index is prepared of information on magnesium alloys of identical or nearly identical composition. These alloys are indexed under Dowmetal symbols, although results of experimental work on AMC alloys are included. Also referred to are the specification symbols of AMS and SAE. Some of the reports contain information on aluminum alloys, which is indexed under the Alcoa symbols.

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