

Fourth Pacific Area Meeting Papers

Symposium on

RADIATION EFFECTS ON METALS AND NEUTRON DOSIMETRY



Published by the
AMERICAN SOCIETY FOR TESTING AND MATERIALS
1916 Race St., Philadelphia 3, Pa.

ASTM Special Technical Publication No. 341

SYMPOSIUM ON RADIATION EFFECTS ON METALS AND NEUTRON DOSIMETRY

Presented at the
FOURTH PACIFIC AREA NATIONAL MEETING
AMERICAN SOCIETY FOR TESTING AND MATERIALS
Los Angeles, Calif., October 2 and 3, 1962



Reg. U. S. Pat. Off.

ASTM Special Technical Publication No. 341

Price \$15.00; to Members \$10.50

Published by the
AMERICAN SOCIETY FOR TESTING AND MATERIALS
1916 Race St., Philadelphia 3, Pa.

©BY AMERICAN SOCIETY FOR TESTING AND MATERIALS 1963

Library of Congress Catalog Card Number: 63-12698

Printed in Baltimore, Md.
January, 1963

FOREWORD

ASTM Committee E-10 on Radioisotopes and Radiation Effects is continuing to sponsor symposia on various aspects of radiation. The latest, this Symposium on Radiation Effects on Metals and Neutron Dosimetry, was held in Los Angeles, Calif., on October 2 and 3, 1962, during the Fourth Pacific Area National Meeting of the Society. Papers were presented during four sessions, while a fifth session was devoted to a Panel Discussion on Possible Mechanisms of Radiation Effects on Metals.

This symposium was of especial interest because of several papers from European atomic energy installations, including some from Sweden, England, France, and from EURATOM Headquarters.

The Panel Discussion and the papers by K. H. Bockhoff, "Neutron and Gamma Ray Dosimetry at EURATOM," and by J. Sebille, "EURATOM Radiation Effects Studies on Structural Materials," are not included in this volume. Two papers not presented at Los Angeles have been included here: D. R. Harries, P. J. Barton, and S. B. Wright, "Effects of Neutron Spectrum and Dose Rate on Radiation Hardening and Embrittlement in Steels," and B. L. Eyre, "A Study of Neutron Irradiation in Alpha Iron and a 1Cr-0.5Mo Pressure Vessel Steel."

Mr. J. R. Hawthorne, Naval Research Laboratory, served as Symposium Chairman. Presiding officers of the various sessions were: Session on Fundamental Studies of Radiation Effects in Metals—D. K. Stevens, U. S. Atomic Energy Commission, and David Rogone, General Atomic, Division of General Dynamics; Session on Neutron Dosimetry—J. B. Trice, General Electric Co., and T. O. Passell, Stanford Research Institute; Session on Irradiation Effects on Ferritic Steels—H. H. Klepfer, General Electric Co., and R. G. Berggren, Oak Ridge National Laboratory; Session on Irradiation Effects in Other Structural Alloys—M. Whitman, U. S. Atomic Energy Commission, and C. R. Sutton, The International Nickel Co., Inc. Mr. J. B. Alger, United States Steel Corp., was moderator of the Panel Discussion.

NOTE.—The Society is not responsible, as a body, for the statements
and opinions advanced in this publication.

CONTENTS

	PAGE
Introduction—J. R. Hawthorne.....	1
Fundamental Studies of Radiation Effects in Metals	
Mechanisms of Atomic Displacements Induced by Radiation—A. Sosin.....	3
Structure of Displacement Cascades Produced by Neutron Irradiation—V. A. J. van Lint.....	33
Discussion.....	45
Mechanical Properties of Irradiated Iron and Iron Alloys—J. G. Y. Chow, S. B. McRickard, and D. H. Gurinsky.....	46
Discussion.....	65
Effects of Neutron Irradiation on Precipitation-Hardening Alloys—C. R. Cupp.....	67
Discussion.....	85
Fundamental Aspects of Radiation Effects on Diffusion-Controlled Reactions in Alloys—Monroe S. Wechsler.....	86
Neutron Dosimetry	
Significance of Neutron Spectrum on Radiation Effects Studies—A. D. Rossin.....	115
Fast-Neutron Dosimetry at the MTR-ETR Site—C. H. Hogg and L. D. Weber.....	133
Fast Neutron Dosimetry for Long-Term Irradiations—R. L. Ritzman, R. Lieberman, J. F. Kircher, and D. N. Sunderman.....	141
The Use of Semiconductor Lithium Drifted p-i-n Junction Detectors for Dosimetry—Norman A. Baily and Gordon Kramer.....	151
Irradiation Effects on Ferritic Steels	
Brittle Fracture and Irradiation Effects in Ferritic Pressure Vessel Steels—R. W. Nichols and D. R. Harries.....	162
Discussion.....	198
Effects of Radiation on Two Low-Alloy Steels at Elevated Temperatures—A. L. Lowe, Jr.....	199
Discussion.....	211
Effect of Neutron Irradiation at 550 F on Charpy Impact Properties of ASTM A 302 Grade B Steel—F. A. Brandt and A. J. Alexander.....	212
Discussion.....	231
Surveillance Tests on Structural Materials in Nuclear Reactors—E. Landerman.....	233
Discussion.....	250
Irradiation Embrittlement and Hardening of Steels and Zircaloy-2 in Pressurized Components—E. Cibois, J. Lemaire, and M. Weisz.....	253
Discussion.....	275
Effects of Neutron Spectrum and Dose Rate on Radiation Hardening and Embrittlement in Steels—D. R. Harries, P. J. Barton, and S. B. Wright.....	276
A Study of Neutron Irradiation in Alpha Iron and a 1Cr-0.5Mo Pressure Vessel Steel—B. L. Eyre.....	294

Irradiation Effects in Other Structural Alloys

Swedish Studies on Irradiation Effects in Structural Materials—M. Grounes and H. P. Myers.	305
Radiation Effects in Reactor Structural Materials—Myron B. Reynolds.	311
Radiation-Induced Property Changes in AISI Type 347 Stainless Steel—F. R. Shober and W. E. Murr.	325
Discussion	341
Effect of Neutron Bombardment on Stress-Rupture Properties of Some Structural Alloys—Norman E. Hinkle.	344
Discussion	359
In-Reactor Creep Measurements on Zircaloy-2—L. J. Chockie, J. J. Holmes, and J. C. Tobin.	363
Neutron Irradiation Effects in A 286, Hastelloy X, and René 41 Alloys—F. C. Robertshaw, J. Moteff, F. D. Kingsbury, and M. A. Pugacz.	372

