IRRADIATION EFFECTS IN STRUCTURAL ALLOYS FOR THERMAL AND FAST REACTORS
IRRADIATION EFFECTS IN STRUCTURAL ALLOYS FOR THERMAL AND FAST REACTORS

A symposium
presented at the
Seventy-first Annual Meeting
AMERICAN SOCIETY FOR TESTING AND MATERIALS

ASTM SPECIAL TECHNICAL PUBLICATION 457

List price $36.00

AMERICAN SOCIETY FOR TESTING AND MATERIALS
1916 Race Street, Philadelphia, Pa. 19103
NOTE

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

The Symposium on Irradiation Effects in Structural Alloys for Thermal and Fast Reactors was presented during the Seventy-first Annual Meeting of the Society held in San Francisco, Calif., 23-28 June 1968. The symposium was sponsored by Committee E-10 on Radioisotopes and Radiation Effects. L. E. Steele, Naval Research Laboratory, served as chairman of this symposium committee consisting of A. L. Bement, John Moteff, Edgar Landerman, F. R. Shober, and W. L. R. Rice. The six sessions were presided over by R. W. Nichols, L. R. Weissert, S. Havel, W. P. Chernock, T. T. Claudson, and K. Zwilsky.
Related
ASTM Publications

Nondestructive Testing of Nuclear Graphite, STP 439 (1968), $8.00

Effects of High-Energy Radiation on Inorganic Substances, STP 400 (1966), $5.25

Radiation Effects in Electronics, STP 384 (1965), $5.00
Contents

Introduction .................................................. 1

Materials for Current Nuclear Power Reactor
(Cladding and Core Structural)

The Effect of Cold Work, Thermal Treatment, and Neutron Irradiation
on the Fracture Toughness of Zircaloy-2—R. G. ROWE AND
R. G. HOAGLAND ........................................... 3

Comparison of In-Reactor Creep and Postirradiation Creep Tests of
Structural Materials for Nuclear Applications—E. R. GILBERT AND
N. E. HARDING ............................................. 17

High-Temperature Tensile Properties of Unirradiated and Thermal Re-
actor Irradiated Nimonic PE16—G. H. BROOKFIELD .......... 38

Irradiation-Induced Embrittlement in Stainless Steel at Elevated Tempera-
ture—M. KANGILASKI, J. S. PERRIN, AND R. A. WULLAERT ... 67

Discussion ..................................................... 87

Materials for Current Power Reactors
(Pressure Vessel Steels)

Irradiation Tests of Several Steels for Reactor Pressure Vessels—
M. HASEGAWA ............................................. 92

Initial Assessments of Notch Ductility Behavior of A533 Pressure Vessel
Steel with Neutron Irradiation—J. RUSSELL HAWTHORNE AND
ULDIS POTAPOVS ......................................... 113

Discussion ..................................................... 134

Notch Ductility, Tensile and Neutron Spectrum Analyses of PM-2A Re-
actor Pressure Vessel—C. Z. SERPAN AND H. E. WATSON .... 135

Irradiation Effects in Pressure Vessel Materials for Steam-Cooled Fast
Reactors—M. GROUNES AND P. LINDHAGEN ................. 156

Damage Mechanisms for Pressure Vessel Steels

The Effect of Substructure on the Biaxial Strength and Irradiation Sta-
bility of ASTM A 302 Grade B Steel—P. W. FLYNN AND
T. A. TROZERA ............................................. 180
CONTENTS

Effects of Interstitial Elements on Radiation Hardening in Mild Steels—
E. A. LITTLE AND D. R. HARRIES .......................... 215

Radiation Hardening and Embrittlement in a Reactor Pressure Vessel
Steel—M. S. WECHSLER, R. G. BERGGREN, N. E. HINKLE, AND
W. J. STELZMAN ........................................ 242

Advances in Reactor Materials

Development of Austenitic Stainless Steels with Improved Resistance to
Elevated-Temperature Irradiation Embrittlement—E. E. BLOOM
AND J. R. WEIR, JR. .................................... 261
Discussion .................................................. 289

Development of a Titanium-Modified Hastelloy N with Improved Re-
sistance to Radiation Damage—H. E. MCCOY AND J. R. WEIR, JR. 290

Effects of Yttrium on the Structure and Post-Irradiation Tensile Prop-
erties of an Iron-Chromium-Aluminum Alloy—A. C. ROBERTS,
D. R. HARRIES, D. R. ARKELL, M. A. P. DEWEY, AND J. D. H. HUGHES 312

Fast Reactor Materials Technology

Development of Fuel Cladding for Fast Reactors—G. W. CUNNINGHAM 329
Effect of Irradiation on Mechanical Properties of Cobalt-Base Alloys—
J. G. W. CHOW ........................................ 336
Neutron Dosimetry for Fast-Reactor Irradiation and Surveillance Testing
—H. H. YOSHITAKA AND W. N. McELROY .................. 342

High-Temperature Embrittlement and AISI Type 316 Austenitic Stainless
Steels After Irradiation—M. WEISZ, J. MALKIN, J. ERLER, AND
J. P. ANDRE ............................................ 352

Postirradiation Tensile Behavior of 300 Series Stainless Steels—J. J.
HOLMES, R. E. ROBBINS, AND A. J. LOVELL ................ 371
Multiaxial In-Reactor Stress-Rupture Strength of Stainless Steels and
a Nickel Alloy—H. J. LAUE, H. BOHM, AND H. HAUCK ........ 390

Comparison of Radiation Damage Studies and Fuel Cladding Per-
formance for Incoloy-800—F. A. COMPRELLI, H. J. BUSBOOM,
AND C. N. SPALARIS ....................................... 400

Effects of Neutron Irradiation on the Creep-Rupture Properties of Type
316 Stainless Steel Tubes—J. STANDRING, I. P. BELL, H. TICKLE,
AND A. GLENDINNING ...................................... 414