IRRADIATION EFFECTS IN STRUCTURAL ALLOYS FOR THERMAL AND FAST REACTORS

AMERICAN SOCIETY FOR TESTING AND MATERIALS
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) *


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 Reactor Irradiated Nimonic PE16—G. H. BROOMFIELD .................................................. 38

Irradiation-Induced Embrittlement in Stainless Steel at Elevated Temperature—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 Reactor 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 Stability 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. YOSHIKAWA 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