

STRUCTURE,  
CONSTITUTION, AND  
GENERAL CHARACTERISTICS  
OF  
WROUGHT FERRITIC  
STAINLESS STEELS

*J. J. Demo*



AMERICAN SOCIETY FOR TESTING AND MATERIALS

# STRUCTURE, CONSTITUTION, AND GENERAL CHARACTERISTICS OF WROUGHT FERRITIC STAINLESS STEELS

Sponsored by  
Committee A-1 on  
Steel, Stainless Steel, and Related Alloys

by J. J. Demo

ASTM SPECIAL TECHNICAL PUBLICATION 619

List price \$7.50  
04-619000-02



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

© by AMERICAN SOCIETY FOR TESTING AND MATERIALS 1977  
Library of Congress Catalog Card Number: 76-42961

### NOTE

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

Reprinted by permission from the  
*Handbook of Stainless Steels*  
edited by D. Peckner and I. M. Bernstein  
McGraw-Hill Book Company, New York

Printed in Baltimore, Md.  
January 1977

# Foreword

This special technical publication appears as Chapter 6 of *Handbook of Stainless Steels* published by McGraw-Hill Book Company and is reprinted here by permission. Committee A-1 on Steel, Stainless Steel, and Related Alloys of the American Society for Testing and Materials is the sponsor of this publication.

## Related ASTM Publications

Bearing Steels: The Rating of Nonmetallic Inclusion, STP 575 (1975),  
\$27.25 (04-575000-02)

Cleaning Stainless Steel, STP 538 (1973), \$18.00 (04-538000-02)

Introduction to Today's Ultrahigh-Strength Structural Steels, STP 498  
(1971), \$3.75 (04-498000-02)

## A Note of Appreciation to Reviewers

This publication is made possible by the authors and, also, the unheralded efforts of the reviewers. This body of technical experts whose dedication, sacrifice of time and effort, and collective wisdom in reviewing the papers must be acknowledged. The quality level of ASTM publications is a direct function of their respected opinions. On behalf of ASTM we acknowledge with appreciation their contribution.

*ASTM Committee on Publications*

## Editorial Staff

Jane B. Wheeler, *Managing Editor*  
Helen M. Hoersch, *Associate Editor*  
Ellen J. McGlinchey, *Assistant Editor*  
Kathleen P. Turner, *Assistant Editor*  
Sheila G. Pulver, *Editorial Assistant*

# Contents

Structure and Constitution	2
Effect of Carbon and Nitrogen	3
Strengthening Mechanisms	5
Strengthening by Heat Treatments	6
Sigma Phase	7
475 °C Embrittlement	9
Summary 475 °C Embrittlement	19
High-Temperature Embrittlement and Loss of Corrosion	21
Background	22
High-Temperature Loss of Corrosion Resistance	23
High-Temperature Embrittlement	33
Notch Sensitivity in Annealed Alloys	44
Weldable, Corrosion-Resistant, Ductile Ferritic Stainless Steels	49
Low Interstitials	50
Interstitial Stabilization	53
Weld Ductilizing Additions	57
Sigma Phase and 475 °C Embrittlement Susceptibility	58
Molybdenum Additions	59
Summary	61

