
**ELECTROCHEMICAL
CORROSION TESTING**

Mansfeld/Bertocci, *editors*

ASTM STP 727

**AMERICAN SOCIETY FOR
TESTING AND MATERIALS**

ELECTROCHEMICAL CORROSION TESTING

A symposium
sponsored by ASTM
Committee G-1 on Corrosion of Metals
AMERICAN SOCIETY FOR
TESTING AND MATERIALS
San Francisco, Calif. 21-23 May 1979

ASTM SPECIAL TECHNICAL PUBLICATION 727
Florian Mansfeld, Rockwell International
Science Center, and Ugo Bertocci, National
Bureau of Standards, editors

ASTM Publication Code Number (PCN)
04-727000-27



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

Copyright © by AMERICAN SOCIETY FOR TESTING AND MATERIALS 1981
Library of Congress Catalog Card Number: 80-68949

NOTE

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

Foreword

The Symposium on Progress in Electrochemical Corrosion Testing was held 21–23 May 1979 in San Francisco, Calif. The symposium was sponsored by ASTM Committee G-1 on Corrosion of Metals. Dr. Florian Mansfeld, Rockwell International Science Center, served as symposium chairman; Dr. Ugo Bertocci, National Bureau of Standards, served as vice-chairman. Drs. Mansfeld and Bertocci also served as editors of this publication.

Related ASTM Publications

Corrosion of Reinforcing Steel in Concrete, STP 713 (1980), \$22.50,
04-713000-27

Corrosion and Degradation of Implant Materials, STP 684 (1979), \$37.75,
04-684000-27

Stress Corrosion Cracking—The Slow Strain-Rate Technique, STP 665
(1979), \$39.75, 04-665000-27

Intergranular Corrosion of Stainless Alloys, STP 656 (1978), \$24.00,
04-656000-27

Atmospheric Factors Affecting the Corrosion of Engineering Metals, STP
646 (1978), \$24.50, 04-646000-27

Corrosion Fatigue Technology, STP 642 (1978), \$32.00, 04-642000-27

Chloride Corrosion of Steel in Concrete, STP 629 (1977), \$21.25,
04-629000-27

Stress Corrosion—New Approaches, STP 610 (1976), \$43.00, 04-610000-27

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*
Helen P. Mahy, *Senior Assistant Editor*
Allan S. Kleinberg, *Assistant Editor*

Contents

Introduction	1
Scanning Reference Electrode Techniques in Localized Corrosion— H. S. ISAACS AND BRIJESH VYAS	3
Potential Dependence of Localized Corrosion in Iron— JAROMÍR TOUŠEK	34
A Method for Quantifying the Initiation and Propagation Stages of Crevice Corrosion—T. S. LEE	43
A Strain-Control Technique for Assessing the Corrosion-Fatigue Sensitivity of Stainless Steels—C. AMZALLAG, B. MAYONOBÉ, AND P. RABBE	69
Potential and Strain-Rate Effects in Slow Strain-Rate Stress Corrosion Cracking of Type 304 Stainless Steel in 35 Percent Magnesium Chloride at 120°C— K. J. KESSLER AND H. KAESCHE	84
Corrosion and Electrochemical Behavior of Iron-Chromium-Nickel Alloys in Concentrated Sulfuric Acid Solutions—H. S. TONG	96
Electrochemical Impedance Techniques in Corrosion Science— D. D. MACDONALD AND M. C. H. MCKUBRE	110
Alternating-Current Impedance Measurements Applied to Corrosion Studies and Corrosion-Rate Determination—I. EPELBOIN, C. GABRIELLI, M. KEDDAM, AND H. TAKENOUTI	150
A Corrosion Monitor Based on Impedance Method— S. HARUYAMA AND T. TSURU	167
Impedance Measurements on Organic Coatings on Mild Steel in Sodium Chloride Solutions—J. D. SCANTLEBURY, K. N. HO, AND D. A. EDEN	187

Digital Faradaic Impedance Measurements on Corroding Copper in Acid Solutions—W. H. SMYRL	198
Evaluation of Electrochemical Techniques for Monitoring of Atmospheric Corrosion Phenomena—FLORIAN MANSFELD	215
Practical Experience with an Electrochemical Technique for Atmospheric Corrosion Monitoring—VLADIMIR KUCERA AND JAN GULLMAN	238
An Electrochemical Technique to Measure Diffusible Hydrogen in Metals (Barnacle Electrode)—J. J. DELUCCIA AND D. A. BERMAN	256
Cyclic Polarization Measurements—Experimental Procedure and Evaluation of Test Data—ROBERT BABOIAN AND G. S. HAYNES	274
Application of Potentiokinetic Hysteresis Technique to Characterize the Chloride Corrosion of High-Copper Dental Amalgams—N. K. SARKAR	283
Direct Measurement of the Corrosion Current for Oxygen-Reduction Corrosion—JOHN POSTLETHWAITE	290
Electrochemical Behavior of Carbon Steel in Fused Salts—C. M. CHEN AND G. J. THEUS	303
Galvanic Corrosion of Copper Alloys—YUICHI ISHIKAWA, NOBUYOSHI HOSAKA, AND SUSUMU HIOKI	327
Electrochemical Investigation of Cavitation-Corrosion Damages of a Pump Casing—YUICHI ISHIKAWA, TOSHINORI OZAKI, SUMIO SUDO, AND SUSUMU HIOKI	339
A Method of Evaluating Polarization Curves for Stainless Steel via a Simple Passivation Model—S.-O. BERNHARDSSON AND ROLF MELLSTRÖM	352
Effect of Large Voltage Modulations on Electrodes Under Charge-Transfer Control—UGO BERTOCCI AND J. L. MULLEN	365
Progress in Mini-Potentiostat Development for Corrosion Testing—H. A. NEWBORN, D. C. BRATLIE, AND C. R. CROWE	381

A Microprocessor-Based Corrosion Measurement System—

W. M. PETERSON AND HOWARD SIEGERMAN

390

Summary

407

Index

409

