Foreword

On 21 Jan. 1964, the Board of Directors approved the formation of Committee G1 on Corrosion of Metals to consolidate the various standard developing bodies concerned with corrosion testing and evaluation. An unexpected benefit of this consolidation was the attraction of a group of corrosion scientists and engineers to the committee. Their efforts provided leadership in the development of standards in areas previously neglected. These areas included electrochemical test methods, stress corrosion cracking methods, and others. In the ensuing 25 years, Committee G1 has developed more than 50 standards and has been responsible for the publication of 35 special technical publications resulting from symposia sponsored by the Committee.

In order to celebrate 25 years of exceptional productivity, Committee G1 put together a series of special events during its fall meeting in Orlando, Florida, 6–10 Nov. 1989. As part of this celebration, the Silver Anniversary Symposium on Corrosion Testing and Evaluation was held. This Symposium covered technical areas where Committee G1 has been active. A series of highlighting lectures was included to cover the state of the art in each area. In addition, research papers provided new unpublished results in these areas. As a result, 38 papers were presented at this symposium. This publication, Corrosion Testing and Evaluation: Silver Anniversary Volume, ASTM STP 1000, contains most of these papers.

The purpose of this STP is to summarize the state of the art in corrosion testing and evaluation in the areas where Committee G1 is active. In addition, this STP highlights areas where research has provided new information in fields related to corrosion testing and evaluation. The STP also covers areas where new standards would be desirable and where existing standards have deficiencies.

Robert Baboian, Texas Instruments, Attleboro, Massachusetts, and Sheldon W. Dean, Air Products and Chemicals, Inc., Allentown, Pennsylvania, served as symposium chairmen and were editors of this publication.
COVER: Artwork supplied by Robert L. Laverdiere, Texas Instruments, Inc.
Contents

Overview

INTRODUCTION

Corrosion—A Problem of International Importance—ROBERT BABOIAN 7

SECTION I: CORROSION DATA AND EVALUATION

Computerization of Corrosion Data—DAVID B. ANDERSON 17

Corrosion Evaluation Information Dissemination Via Computers—
CHARLES P. STURROCK, DAVID B. ANDERSON, ALBERT S. KRISHER,
AND THADDEUS S. LEE 26
Discussion 37

The Nondestructive Characterization of Corrosion—WILLIAM G. CLARK, JR., AND
MICHAEL J. METALA 39
Discussion 49

Evaluation of Corrosion Failures in Pumps—COLIN McCAUL 50

Correlation of Failure Analysis Corrosion Testing—GEORGE NEKOKSA 66

Choice of Testing, Evaluation Methods, and Quality Criteria in Corrosion
Engineering—KAREL BARTON, DAGMAR KNOTKOVA, AND PETR HOLLER 80

SECTION II: CORROSION IN ENVIRONMENTS

Corrosion Testing in Soils—Past, Present, and Future—VICTOR CHAKER 95
Discussion 110

Measuring the Corrosion of Metals in Soil—EDWARD ESCALANTE 112
Discussion 123
Field Soil Corrosivity Testing—Engineering Considerations—J. DAVID PALMER

Stress-Corrosion Cracking of Mn-Bronze Castings and Test Specimens in New York City Water Distribution Shafts—GEORGE A. ANDERSEN AND PAUL B. DONNELLAN

Erosion-Corrosion Measuring Devices—MICHAEL SCHORR, ERICA WEINTRAUB, AND DAVID ANDRASI

SECTION III: ATMOSPHERIC TESTS

Corrosion Testing of Metals Under Natural Atmospheric Conditions—SHELDON W. DEAN

Discussion

Long-Term Atmospheric Corrosion Behavior of Various Grades of Stainless Steel in Rural, Industrial, and Marine Environments—EARL A. BAKER AND W. W. KIRK

Advanced Laboratory and Field Exposure Systems for Testing Materials—JOHN W. SPENCE, EDWARD O. EDNEY, FRED H. HAYNIE, DAVID C. STILES, ERIC W. CORSE, MIKE S. WHEELER, AND SUSAN F. CHEEK

Discussion

Derivation of a Damage Function for Galvanized Steel Structures: Corrosion Kinetics and Thermodynamic Considerations—JOHN W. SPENCE AND FRED H. HAYNIE

Evaluation of an Atmospheric Damage Function for Galvanized Steel—FRED H. HAYNIE, JOHN W. SPENCE, FRED W. LIPFERT, STEPHEN D. CRAMER, AND L. GARNER MCDONALD

Atmospheric Factors Affecting the Corrosion of Zinc, Galvanized Steel, and Copper—STEPHEN D. CRAMER AND L. GARNER MCDONALD

A Study of Large Sets of ASTM G 84 Time-of-Wetness Sensors—JEAN-JACQUES HECHLER, JEAN BOULANGER, DENIS NOËL, ROBERT DUFRESNE, AND CHRISTIAN PINON

SECTION IV: LABORATORY TESTS

Review of Laboratory Corrosion Tests and Standards—GARDNER HAYNES

Application of the Critical Pitting Temperature Test to the Evaluation of Duplex Stainless Steel—RUSSELL D. KANE, S. MARK WILHELM, AND DALE R. McINTYRE
Practice for Conducting Corrosion Coupon Tests on Zirconium and Its Alloys—
TE-LIN YAU, JEFF A. ANDREWS, H. ROB HENSON, AND DERRILL R. HOLMES 303

A Comparison of Sulfide Stress Cracking Tests—RICHARD S. TRESEDER 312

Stress Corrosion Cracking in Alloy 400 (UNS NO4400) at Room Temperature—
LEAH G. EVERHART AND CHRISTOPHER E. PRICE 319
Discussion 334

Using Multisample Test Apparatus for the ASTM A 262, Practice C Nitric Acid Corrosion Testing of Types 304 and 304L Stainless Steels—
RICHARD A. CORBETT 335

SECTION V: ELECTROCHEMICAL TESTS

Electrochemical Methods for Laboratory Corrosion Testing—JOHN R. SCULLY 351

Simple Models/Practical Answers Using the Electrochemical Impedance Technique—DAVID C. SILVERMAN 379
Discussion 395

Electrochemical Impedance Measurements for Evaluating and Predicting the Performance of Organic Coatings for Atmospheric Exposure—
THERESA C. SIMPSON, PATRICK J. MORAN, HOWARD HAMPEL, GUY D. DAVIS, BARBARA A. SHAW, CHIKE O. ARAH, TAMMY L. FRITZ, AND KENNETH L. ZANKEL 397
Discussion 412

Electrochemical Screening of Synergism of Surfactants in the Inhibition of Corrosion of Aluminum by Silicate—STANLEY T. HIROZAWA AND DANIEL E. COKER 413

Electrochemical Methods of Determining the Corrosivity of Steel in Concrete—
NEAL S. BERKE AND MARIA C. HICKS 425
Discussion 440

Indexes 441