Foreword

This publication, *Hydrogen Embrittlement: Prevention and Control*, contains papers presented at the Second National Symposium on Test Methods for Hydrogen Embrittlement: Prevention and Control, which was held in Los Angeles 24–26 May 1985. The symposium was sponsored by ASTM Subcommittee F7.4 on Hydrogen Embrittlement. Louis Raymond, Ph.D., L. Raymond & Associates, presided as symposium chairman and was editor of this publication.
Contents

Introduction—L. Raymond 1

Section 1: Overview

Opening Remarks—C. Sonnino 7

Overview: Sections 1 and 2—A. A. Anctil 8

Hydrogen Embrittlement Test Methods: Current Status and Projections—L. Raymond 10

Electrochemical Aspects of Hydrogen in Metals—J. J. Deluccia 17

Section 2: Current Standards and Projections

Hydrogen Embrittlement Coverage by U.S. Government Standardization Documents—E. T. Clegg 37

Other ASTM Committees and ISO Committees Involved in Hydrogen Embrittlement Test Methods—A. W. Grobin, Jr. 46

Specifications for Hydrogen Control Testing of Materials—D. J. Coates 55

Accelerated Acceptance Testing for Hydrogen Embrittlement Control—R. V. Dreher 60

Assessment of the Degree of Hydrogen Embrittlement Produced in High-Strength 4340 Steel by Plating-and-Baking Processes Using Slow Strain Rate Testing—W. J. Pollock 68

Panel Discussion: Sections 1 and 2 81

Section 3: Hydrogen in Steel and Titanium

Opening Remarks—R. Fricioni 89

Electrochemical Sensor for the Determination of Hydrogen in Metals by Potential Measurements—A. Mackor, C. W. de Kreuk, and J. Schoonman 90

The Barnacle Electrode Method to Determine Diffusible Hydrogen in Steels—D. A. Berman and V. S. Agarwala 98

The Development of an In-Situ Sensor for Measuring the Hydrogen Content of Liquid Iron—T. Ohtsubo, H. Kawase, and S. Yamazaki 105
A Study of the Effect of Voids on Hydrogen Diffusion Through Electroslag Refined Steel—M. WANG AND P. G. SHEWMON

Panel Discussion: Section 3

Summary: Section 3—R. FRICIONI

SECTION 4: RELATIVE SUSCEPTIBILITY

Overview: Section 4—D. R. McINTYRE

Sensitivity of Steels to Degradation in Gaseous Hydrogen—H. J. CIALONE AND J. H. HOLBROOK
Discussion

The Present Status of the Disk Pressure Test for Hydrogen Embrittlement—J.-P. FIDELLE
Discussion

Screening Tests for Hydrogen Stress Cracking Susceptibility—W. R. CRUMLY

Ranking Materials for Extreme Sour Gas Service Using the Slow Strain Rate Method—D. R. McINTYRE

Discussion

Selection of Petroleum Industry Materials Through Use of Environmental Cracking Tests—S. W. CIARALDI
Discussion

SECTION 5: HYDROGEN IN WELDING

Overview: Section 5—J. BLACKBURN


Testing of Welding Electrodes for Diffusible Hydrogen and Coating Moisture—T. A. SIEWERT

Diffusible Hydrogen Testing by Gas Chromatography—M. A. QUINTANA AND J. R. DANNECKER

Panel Discussion: Gas Chromatography

The Effect of Weld Metal Diffusible Hydrogen on the Cracking Susceptibility of HY-80 Steel—R. J. WONG
In-Process Prediction of the Diffusible Hydrogen Content of Gas-Metal Arc—D. R. WHITE AND W. G. CHIONIS 287

Panel Discussion: Diffusible Hydrogen 299

SECTION 6: PREVENTION AND CONTROL: CASE HISTORIES

Overview: Section 6—W. FIELD 303

Prevention of Hydrogen Embrittlement by Surface Films—G. T. MURRAY 304
Discussion 316

Hydrogen Embrittlement and Relief Treatment Study of Zinc Phosphate-Coated Submunitions—G. P. VOORHIS 318
Discussion 334

Examination of Cadmium-Plated Aircraft Fasteners for Hydrogen Embrittlement—M. LEVY AND G. A. BRUGGEMAN 335
Discussion 341

Proof Test Logic for Hydrogen Embrittlement Control—W. E. KRAMS 343
Discussion 349

SECTION 7: RESEARCH IN PROGRESS

Quantitative Analysis of Critical Concentrations for Hydrogen-Induced Cracking—G. M. PRESSOYRE AND F. M. FAURE 353

Assessment of the Degree of Hydrogen Embrittlement Produced in Plated High-Strength 4340 Steel by Paint Strippers Using Slow Strain Rate Testing—W. J. POLLOCK AND C. GREY 372


Hydrogen Transport, Microstructure, and Hydrogen-Induced Cracking in Austenitic Stainless Steels—T. PERNG AND C. ALTSTETTER 403

Temperature Dependence of Fatigue Crack Propagation in Niobium-Hydrogen Alloys—N. POLVANICH AND K. SALAMA 417

Index 429