

# **Corrosion of Metals Under Thermal Insulation**

**Pollock/Barnhart**  
editors

**ASTM STP 880**

# CORROSION OF METALS UNDER THERMAL INSULATION

A symposium sponsored by  
ASTM Committees C-16 on Thermal  
Insulation and G-1 on Corrosion  
and the National Association of  
Corrosion Engineers, the Institution  
of Corrosion Science and Technology, and  
the Materials Technology Institute  
of the Chemical Process Industries

ASTM SPECIAL TECHNICAL PUBLICATION 880  
Warren I. Pollock, E. I. du Pont de Nemours  
and Company, and Jack M. Barnhart,  
Thermal Insulation Manufacturers  
Association, editors

ASTM Publication Code Number (PCN)  
04-880000-27



1916 Race Street, Philadelphia, PA 19103

**Library of Congress Cataloging in Publication Data**

Main entry under title:

Corrosion of metals under thermal insulation.

(ASTM special technical publication; 880)

Papers presented at the symposium held at San Antonio, TX, 11-13 Oct. 1983.

Includes bibliographies and index.

"ASTM publication code number (PCN) 04-880000-27"

1. Corrosion and anti-corrosives—Congresses.  
2. Insulation (Heat)—Congresses. I. Pollock,  
Warren I. II. Barnhart, Jack M. III. ASTM Committee  
C-16 on Thermal Insulation. IV. Series.  
TA462.C6567 1985 621.1'623 85-10616  
ISBN 0-8031-0416-2

Copyright © by AMERICAN SOCIETY FOR TESTING AND MATERIALS 1985  
Library of Congress Catalog Card Number: 85-10616

**NOTE**

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

# Foreword

The symposium on Corrosion of Metals Under Thermal Insulation was presented at San Antonio, TX, 11–13 Oct. 1983. The symposium was sponsored by ASTM Committees C-16 on Thermal Insulation and G-1 on Corrosion and by the National Association of Corrosion Engineers, the Institution of Corrosion Science and Technology, and The Materials Technology Institute of the Chemical Process Industries. Warren I. Pollock, E. I. du Pont de Nemours and Company, and Jack M. Barnhart, Thermal Insulation Manufacturers Association, presided as chairmen of the symposium and are editors of this publication.

## Related ASTM Publications

Atmospheric Corrosion of Metals, STP 767 (1982), 04-767000-27

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

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

## A Note of Appreciation to Reviewers

The quality of the papers that appear in this publication reflects not only the obvious efforts of the authors but also the unheralded, though essential, work of the reviewers. On behalf of ASTM we acknowledge with appreciation their dedication to high professional standards and their sacrifice of time and effort.

*ASTM Committee on Publications*

# ASTM Editorial Staff

Susan L. Gebremedhin  
Janet R. Schroeder  
Kathleen A. Greene  
Bill Benzing

# Contents

<b>Introduction</b>	1
<b>TECHNICAL OVERVIEW</b>	
<b>The Function of Thermal Insulation—JACK M. BARNHART</b>	5
<b>THE PROBLEM</b>	
<b>Factors Affecting Corrosion of Carbon Steel Under Thermal Insulation—PETER LAZAR, III</b>	11
<b>Factors Affecting the Stress Corrosion Cracking of Austenitic Stainless Steels Under Thermal Insulation—DALE McINTYRE</b>	27
<b>A Review of the European Meeting on Corrosion Under Lagging Held in England, November 1980—JAMES A. RICHARDSON</b>	42
<b>THERMAL INSULATION MATERIALS</b>	
<b>Thermal Insulation Materials: Generic Types and Their Properties—GEORGE E. LANG</b>	63
<b>FIELD EXPERIENCE</b>	
<b>Experience with Corrosion Beneath Thermal Insulation in a Petrochemical Plant—TORE SANDBERG</b>	71
<b>Recent Experiences with Corrosion Beneath Thermal Insulation in a Chemical Plant—VICTOR C. LONG AND PAULA G. CRAWLEY</b>	86
<b>Failure of Type 316 Stainless Steel Nozzles in Contact with Fire Retardant Mastic—B. J. MONIZ AND M. C. RITTER</b>	95
<b>External Stress Corrosion Cracking of Stainless Steel Under Thermal Insulation—20 Years Later—WILLIAM G. ASHBAUGH</b>	103
<b>Shell and Jacket Corrosion of a Foamed In-Place Thermally Insulated Liquefied Petroleum Gas Tank—DONALD O. TAYLOR AND RODNEY D. BENNETT</b>	114



<b>A Study of Corrosion of Steel Under a Variety of Thermal Insulation Materials—</b>	121
WILLIAM G. ASHBAUGH AND THOMAS F. LAUNDRIE	
<b>Behavior of a Copper Water Tube Exposed to Natural Carbonaceous Granular and Cellulosic Insulation Materials—</b>	132
JAMES R. MYERS AND ARTHUR COHEN	

## CONTROL MEASURES

<b>Controlling Carbon Steel Corrosion Under Insulation—</b>	145
PAUL E. KRYSTOW	
<b>Protective Coating System Design for Insulated or Fireproofed Structures—</b>	155
PETER A. COLLINS, JOHN F. DELAHUNT, AND DEBBIE C. MAATSCH	
<b>Prevention of Chloride Stress Corrosion Cracking Under Insulation—</b>	165
LOUIS C. SUMBRY AND E. JEAN VEGDAHL	
<b>Designing to Prevent Corrosion of Metals Under Insulation—</b>	178
CHARLES T. METTAM	
<b>Use of Aluminum Foil for Prevention of Stress Corrosion Cracking of Austenitic Stainless Steel Under Thermal Insulation—</b>	188
JAMES A. RICHARDSON AND TREVOR FITZSIMMONS	
<b>Using Specifications to Avoid Chloride Stress Corrosion Cracking—</b>	199
JOHN W. KALIS, JR.	
<b>Use Inspection as a Means of Reducing Failures Caused By Corrosion Under Wet Insulation—</b>	204
HERBERT A. MOAK	

## TEST METHODS

<b>A New Apparatus and Test Procedure for Running ASTM C 692 Stress Corrosion Cracking Tests—</b>	211
FRANCIS B. HUTTO, JR., RALPH G. TISSOT, JR., AND THOMAS E. WHITAKER	
<b>Comparisons of Several Accelerated Corrosiveness Test Methods for Thermal Insulating Materials—</b>	220
KEITH G. SHEPPARD, SUNIL PATEL, MUKESH TANEJA, AND ROLF WEIL	
<b>Index</b>	231

ISBN 0-8031-0416-2