



Pendulum Impact Machines

Procedures and Specimens

T. Siewert, M. Manahan, C. McCowan, Editors

STP 1476



STP 1476

Pendulum Impact Machines: Procedures and Specimens

*Thomas Siewert, Michael Manahan, and Christopher McCowan,
editors*

ASTM Stock Number: STP1476



ASTM International
100 Barr Harbor Drive
PO Box C700
West Conshohocken, PA 19428-2959

Printed in the U.S.A.

Library of Congress Cataloging-in-Publication Data

Pendulum impact machines : procedures and specimens / Thomas Siewert, Michael Manahan, and Christopher McCowan, editors.

p. cm. — (STP 1476)

ISBN 0-8031-3402-9 ISBN 978-0-8031-3402-7

1. Impact—Testing—Equipment and supplies. 2. Pendulum. 3. Notched bar testing—Equipment and supplies. I. Siewert, T. A. II. Manahan, Michael P., 1953– III. McCowan, C. N. (Christopher N.). IV. Series: ASTM special technical publication ; 1476.

TA418.34.P46 2006

620.1'125—dc22

2006016951

Copyright © 2006 AMERICAN SOCIETY FOR TESTING AND MATERIALS INTERNATIONAL, West Conshohocken, PA. All rights reserved. This material may not be reproduced or copied, in whole or in part, in any printed, mechanical, electronic, film, or other distribution and storage media, without the written consent of the publisher.

Photocopy Rights

Authorization to photocopy items for internal, personal, or educational classroom use, or the internal, personal, or educational classroom use of specific clients, is granted by the American Society for Testing and Materials International (ASTM) provided that the appropriate fee is paid to the Copyright Clearance Center, 222 Rosewood Drive, Danvers, MA 01923; Tel: 978-750-8400; online: <http://www.copyright.com/>.

Peer Review Policy

Each paper published in this volume was evaluated by two peer reviewers and at least one editor. The authors addressed all of the reviewers' comments to the satisfaction of both the technical editor(s) and the ASTM International Committee on Publications.

The quality of the papers in this publication reflects not only the obvious efforts of the authors and the technical editor(s), but also the work of the peer reviewers. In keeping with long-standing publication practices, ASTM International maintains the anonymity of the peer reviewers. The ASTM International Committee on Publications acknowledges with appreciation their dedication and contribution of time and effort on behalf of ASTM International.

Foreword

This publication consists primarily of the papers presented at the Second Symposium on Pendulum Impact Machines: Procedures and Specimens, sponsored by ASTM Committee E28 on Mechanical Testing and its Subcommittee E28.07 on Impact Testing. The Symposium was held on November 10, 2004 in Washington, D.C., in conjunction with the standards development meetings of Committee E-28. The Symposium was organized to commemorate the development of and rapid advancement of instrumented impact testing about 100 years ago, and to discuss some current issues.

This book includes the nine papers presented at the Symposium and another one submitted only for the proceedings (with lead author Vigliotti). The papers are organized into four sections by topic: Historical Developments in Impact Testing, Impact Test Procedures and Machine Effects, Reference Specimens, and Issues with Instrumented Strikers. The symposium was chaired jointly by Tom Siewert and Chris McCowan, of the National Institute of Standards and Technology, and Michael P. Manahan, Sr., of MPM Technologies, Inc.

Contents

Overview

SESSION I: HISTORICAL DEVELOPMENTS IN IMPACT TESTING	
The History of Instrumented Impact Testing —M. P. MANAHAN, SR. AND T. A. SIEWERT	3
The Development of Procedures for Charpy Impact Testing —T. A. SIEWERT AND C. N. MCCOWAN	12
SESSION II: IMPACT TEST PROCEDURES AND MACHINE EFFECTS	
Effects of Removing and Replacing an 8-mm Charpy Striker on Absorbed Energy — D. P. VIGLIOTTI AND J. L. VIGLIOTTI	25
SESSION III: REFERENCE SPECIMENS	
International Comparison of Impact Reference Materials (2004) —C. MCCOWAN, G. ROEBBEN, Y. YAMAGUCHI, S. LEFRANÇOIS, J. SPLETT, S. TAKAGI, AND A. LAMBERTY	31
Certification of Charpy V-Notch Reference Test Pieces at IRMM — G. ROEBBEN, A. LAMBERTY, AND J. PAUWELS	40
Uncertainty Analyses on Reference Values of Charpy Impact Test Specimens — S. TAKAGI, Y. YAMAGUCHI, AND T. USUDA	49
Analysis of Charpy Impact Verification Data: 1993–2003 —J.D. SPLETT AND C.N. MCCOWAN	62
Reference Impact Specimens Made from Low Carbon Steel: Report on Production and Use —L. HEPING AND Z. XING	78
Impact Characterization of Sub-Size Charpy V-Notch Specimens Prepared from Full-size Certified Reference Charpy V-Notch Test Pieces —E. LUCON, J. L. PUZZOLANTE, G. ROEBBEN, AND A. LAMBERTY	84

SESSION IV: ISSUES WITH INSTRUMENTED STRIKERS

Different Approaches for the Verification of Force Values Measured with Instrumented Charpy Strikers—E. LUCON, R. CHAOUADI, AND E. VAN WALLE	95
---	----

Overview

In the past, ASTM Subcommittee E28.07 (and its predecessor, E-1.7) has sponsored seven symposia on impact testing, published in Proceedings of the Twenty-Fifth Annual Meeting (1922), Proceedings of the Forty-First Annual Meeting (1938), STP 176 (1956), STP 466 (1970), STP 1072 (1990), STP 1248 (1995), and STP 1380 (1999). These symposia covered a broad range of topics and occurred rather infrequently, at least until 1990. The period before 1990 might be characterized as one in which the Charpy test procedure became broadly accepted and then changed very slowly. However, the last three symposia, “Charpy Impact Test: Factors and Variables”, “Pendulum Impact Machines: Procedures and Specimens for Verification”, and “Pendulum Impact Testing: A Century of Progress”, were driven by new forces: a recognition within ISO Technical Committee 164 - Subcommittee 4 (Pendulum Impact) of some shortcomings in the procedure, and a growing interest in instrumented impact testing. These STPs (1072, 1248 and 1380), proved to be of interest to many general users of the test, but were of particular interest to the members of ASTM Subcommittee E28.07 (the subcommittee responsible for Standard E-23 on the Charpy test). During the past 15 years, the data presented at those Symposia have been the single most important factor in determining whether to change various requirements in Standard E-23. The data have also been useful in supporting tolerances and procedural details during the reballoting of ISO Standard 442 (now ISO 148-1) on Charpy testing, and in the refinement of instrumented impact test procedures.

Several years ago, the E28 Subcommittee on Symposia suggested that it was time to schedule another symposium on Charpy impact testing. Once again, we would bring together impact test researchers from around the world to share their latest discoveries and to provide input for further improvements in the test standards. We also discovered that instrumented impact testing was near its Centenary, and including a summary of the history seemed appropriate. In fact, the first paper reviews the very beginnings of instrumented impact testing, reported by Dunn in 1897 (an indirect method using a tuning fork, a light beam, optical film on a disk, and a “crusher gage”) and a significant advance by Gargarin in 1912 (the direct and simultaneous measurement of force and displacement by use of a light beam, a low-mass mirror, and a spinning disk covered with optical film). Another paper on history traces the developments of impact test procedures over the past century. As noted in STP 1380, it seems as though the period of a century ago marked a time of the most rapid discovery and innovation in impact testing.

As in many of the previous symposia, the 2004 symposium was successful in attracting contributions from many countries. Because of its focus on measurement issues, the majority of the authors were from national measurement institutes and standardization societies.

The future of pendulum impact testing appears bright, as it continues to be specified in many construction codes and standards.

Acknowledgments

We appreciate the assistance of Committee E28, including both its Chairman, Earl Ruth, and its members, many of whom helped by chairing the sessions and recruiting abstracts.

Thomas Siewert

Christopher McCowan

National Institute of Standards and Technology

Michael Manahan

MPM Technologies, Inc.



www.astm.org

ISBN 0-8031-3402-9

Stock #: STP1476