

PENDULUM IMPACT TESTING

A Century of Progress

THOMAS A. SIEWERT AND
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EDITORS



STP 1380

STP 1380

Pendulum Impact Testing: A Century of Progress

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ASTM Stock Number: STP1380



ASTM
100 Barr Harbor Drive
West Conshohocken, PA 19428-2959

Printed in the U.S.A.

Library of Congress Cataloging-in-Publication Data

Pendulum impact testing : a century of progress / Thomas A. Siewert and Michael P. Manahan, editors.

p. cm.—(STP; 1380)

ASTM Stock Number: STP1380

ISBN 0-8031-2864-9

1. Materials—Dynamic testing. 2. Impact. 3. Notched bar testing. 4. Testing-machines.

I. Siewert, T. A. II. Manahan, Michael P., 1953– III. ASTM special technical publication; 1380.

TA418.34 .P463 2000

620.1'125—dc21

00-038123

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Foreword

This publication primarily consists of papers presented at the Symposium on Pendulum Impact Testing: A Century of Progress, sponsored by ASTM Committee E28 on Mechanical Testing and its Subcommittee E28.07 on Impact Testing. The Symposium was held on May 19 and 20, 1999 in Seattle, Washington, in conjunction with the standards development meetings of Committee E28. The Symposium marks the 100 year anniversary of the invention of the pendulum impact test by an American civil engineer named S. Bent Russell, and the research and standardization efforts of G. Charpy during the early part of the 20th century.

This book includes 21 papers that were presented at the Symposium and two others submitted only for the proceedings (one with lead author Yamaguchi and the other with lead author Hughes). The papers are organized into four sections by topic: Background of Impact Testing; Reference Energies, Machine Stability and Calibration; Impact Test Procedures; and Fracture Toughness Assessment from Impact Test Data. In addition, the background section includes reprints of two landmark papers, one published in 1898 and one in 1901, that describe significant achievements in the development of the test equipment and procedures. The symposium was chaired jointly by Tom Siewert, of the National Institute of Standards and Technology, and Dr. Michael P. Manahan, Sr., of MPM Technologies, Inc.

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Overview

Overview

ASTM Subcommittee E28.07 (and its predecessor E01.7) has sponsored six 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), and STP 1248 (1995). 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 two symposia, “Charpy Impact Test: Factors and Variables” and “Pendulum Impact Machines: Procedures and Specimens for Verification,” were driven by new forces; a recognition within ISO Technical Committee 164-Subcommittee four (Pendulum Impact) of some shortcomings in the procedure; and a growing interest in instrumented impact testing. These STPs, 1072 and 1248, 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 E23 on the Charpy test). During the past ten years, the data presented at those Symposia have been the single most important factor in determining whether to change various requirements in Standard E23. The data have also been useful in supporting tolerances and procedural details during the rebaloting of ISO Standard 442 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 that 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. The test was also near its Centenary, and a symposium to mark this anniversary seemed appropriate. Of course, this fact led to our very striking title. However, the choice of the date for the symposium was complicated by the fact that the inventory of the pendulum impact test is S. Bent Russell, while the test bears the name of G. Charpy. Details concerning the history of the test are reported in the first paper of this STP. While G. Charpy did publish a landmark paper in 1901 (translated and reprinted in this volume) and later led the international committee that proved the value of pendulum impact testing, an 1898 paper by Russell (also reprinted in this volume) was the first to both describe the mechanics of the pendulum impact machine design and report impact data obtained using such a machine. The 1898 Russell paper also offers an excellent tutorial on the contemporary knowledge of the effect of loading rate on impact resistance (then known as resilience), important variables in machine calibration, and representative data on common construction materials. The date of the symposium was chosen to honor the contributions of both Russell and Charpy. As can be seen from a review of the early papers in this field, it seems as though the turn of the last century marked the time of the most rapid development and use of impact testing.

As was the previous symposium, the 1999 symposium was successful in attracting contributions from many countries. In fact, the majority (thirty-seven) of the fifty authors and coauthors are from outside the U.S., a broader international participation than previous symposia.

The future of pendulum impact testing appears bright, as it continues to be specified in many construction codes and standards. Additional details on the economic importance of pendulum impact testing were included in an earlier version of our review of the history and importance of impact testing (the first paper in this STP). This earlier paper can be found on page 30 of the February 1999 issue of *Standardization News*, where it was recognized as winning third place in the ASTM Impact of Standards Competition. The early history of impact testing which led to the recognition of Russell as the inventor of the Charpy impact test was reported in October 1996 issue of *Standardization News*.

Even after 100 years of use, new aspects of the test continue to be discovered, and of course, any test can be improved as technology reveals new ways to reduce the scatter in the test variables. The symposium also reflects the beginning of a new research thrust to obtain fracture toughness from the Charpy test. It is expected that fracture toughness research, particularly in relation to the Charpy test, will continue over the next 100 years. We anticipate many more symposia on impact testing in the future.

Acknowledgments

We appreciate the assistance of Subcommittee E28.07, its Chairman, Chris McCowan, and its members, many of whom helped by chairing the sessions and by reviewing the manuscripts. We also appreciate the assistance of E. Ruth (U.S. Delegate to ISO Committee 164-TC4 for a number of years) and J. Millane (Secretary of ISO Committee 164-TC4) who helped to encourage international participation. We would also like to thank the ASTM staff who helped with symposium arrangements and the other myriad of details that are necessary for a successful symposium.

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ISBN 0-8031-2864-9