Introduction

This special technical publication consists of four papers presented at the Symposium on Fracture Toughness Testing at Cryogenic Temperatures at the 1970 Annual Meeting of the American Society for Testing and Materials, held in Toronto, Canada. The session was conceived by the Low Temperature Panel of the ASTM-ASME Joint Committee on Effect of Temperature on the Properties of Metals and cosponsored and supported by ASTM Committee E-24 on Fracture Testing of Metals and the Aerospace Panel of the Joint Committee.

The symposium was organized to provide a current picture of the state of the art in fracture toughness testing at cryogenic temperatures. Of principal interest was the application of the foundation of fracture toughness testing, based upon modified linear elastic fracture mechanics and built by ASTM Committee E-24, to the field of ultralow temperatures. The four papers in this volume are representative of the situation today. The Vishnevsky-Steigerwald and Nelson-Kaufman papers describe direct applications of the ASTM plane-strain fracture toughness test method (E 399-70) to cryogenic evaluations, although the temperature control procedures used in that program (carried out several years ago) are not recommended today. The paper by L. R. Hall presents comparative fracture toughness data for several different specimen designs, including those covered by the ASTM method and surface flawed specimens, at various temperatures. The fourth, by Orange et al, moves more strongly into the complex area of surface flaws now being attacked by ASTM Committee E-24 and presents an analytical treatment of cryogenic data.

The Vishnevsky-Steigerwald paper merits special attention, as it is the result of a program developed by the Low Temperature Panel and sponsored by the Metal Properties Council with the specific intent of developing cryogenic fracture toughness data suitable for consideration for handbook use. It is the official publication of the final report from that program. All of the detailed data, on file in the Metal Properties Council Office in the Engineering Center in New York City, are available for further study as fracture test methods evolve. The results of this program will also be of special interest to the novice in fracture toughness testing, cryogenic or otherwise. They provide ample evidence of the pitfalls and practical problems that may be encountered in obtaining valid $K_{IC}$ values.
Three other presentations that do not appear in this volume were made at the symposium:

1. Fracture Behavior of Three Cryogenic Materials (Aluminum Alloys 2021-T81 and 7007-T6 and a Low Silicon Content 301 Stainless steel); by F. R. Schwartzberg, R. D. Keys, and T. F. Keifer; Martin-Marietta Co., Denver, Colo.


These papers are not presented in this volume principally because they are not compatible with ASTM style and concepts. They do, however, contain valuable information in certain specialized fields. Interested persons are referred to the authors for copies of the original manuscripts.

It is appropriate here to express, on behalf of the Low Temperature Panel, our gratitude to the Aerospace Panel of the Joint Committee and ASTM Committee E-24 for their support of this symposium and, especially, to the Metal Properties Council for their funding of the program leading to first report in this volume. Also, special thanks are due J. A. Boysen for his assistance in setting up the program and cochairmaning the symposium.

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