Introduction

This Special Technical Publication brings together a set of papers that were presented at a Panel Session on Plane Strain Crack Toughness sponsored by the ASTM E-24 Committee on Fracture Testing of Metals during the 1968 ASTM Annual Meeting in San Francisco. The main purpose of this Panel Session was to review the practical experience in fracture toughness testing which had developed since ASTM Committee E-24 placed its major efforts in standardization on methods of test for plane strain fracture toughness. These efforts were started early in 1965, and the initial developments were described in *ASTM STP 410*.[1] The paper by Kaufman reviews these developments and gives a brief history of ASTM Committee E-24 activity. In the latter part of 1966 Subcommittee I of ASTM Committee E-24 on High Strength Metallic Materials formulated a Proposed Recommended Practice for Plane Strain Fracture Toughness Testing of High Strength Materials Using a Fatigue-Cracked Bend Specimen. Draft copies of this document were made available early in 1967, and during the next year and a half considerable experience was gained in applying the Proposed Practice to a wide variety of metallic materials.

During this trial period various practical problems were encountered, some due to the inherent limitations of elastic crack mechanics and others associated with certain details of specimen preparation and testing. The members of the Panel, who all had well-established fracture testing programs, were asked to emphasize these problem areas. As a result of this Panel meeting and subsequent discussions among the ASTM E-24 Committee members several changes were made in the Recommended Practice, and a revised document was published in the *1969 ASTM Book of Standards*. This revision incorporated a compact tension specimen as well as the bend specimen, and was designated as a Proposed Method of Test for Plane Strain Fracture Toughness of Metallic Materials. This Proposed Method was subsequently further revised as described in the concluding contribution to this STP and was advanced to a Tentative Method (E 399–70T), a copy of which has been bound at the back of this volume.

Since the papers which appear in this STP were presented, ASTM Committee E-24 Method of Test has been incorporated into various specifications issued by both the U. S. Government and by private industry. It forms

[1] Brown, W. F., Jr., and Srawley, J. E., *Plane Strain Crack Toughness Testing of High Strength Metallic Materials, ASTM STP 410*, American Society for Testing and Materials, 1966.

a part of the Aerospace Material Document series issued by the Society of Automotive Engineers and is also the basis for qualifying K_{Ic} data for incorporation into *MIL-Hdk-5*. These applications have revealed certain aspects of the Test Method which could be improved, but, what is more important, they have shown that there is a strong desire on the part of many investigators to compromise what they consider to be the overly strict specimen size requirements. Suggestions that the required crack length or specimen thickness or both could be reduced appear in several of the papers of this volume. This concern about specimen size arises naturally out of attempts to apply the Test Method to materials having lower strength and higher toughness than those originally intended by the ASTM E-24 Committee.

This volume contains two contributions that were not part of the Panel Session on Plane Strain Crack Toughness. The first is a paper by J. R. Low, Jr., and his associates describing some recently completed work on the fractographic analysis of the aluminum alloy 2014–T6. This paper is quite pertinent since it provides a plausible explanation for the relatively low plane strain fracture toughness characteristic of this and possibly other high-strength aluminum alloy plate. The second is a contribution by J. E. Srawley and myself entitled "Commentary on Present Practice." This not only summarizes the salient features of the various papers, but also attempts to clarify certain aspects of plane strain fracture toughness testing where there appears to be some confusion.

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