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Plastics — Determination of mode I plane-strain crack-arrest toughness

Plastiques — Détermination de la ténacité d'arrêt de fissure en déformation plane

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Contents

Foreword

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The committee responsible for this document is ISO/TC 61, *Plastics*, Subcommittee SC 2, *Mechanical properties*.

Introduction

There has been much interest in a better understanding of the fracture behaviour of polymeric materials and, as a consequence, several International Standard methods for evaluating the fracture properties have been developed. In the light of the fact that these standard methods provide critical information on fracture prevention of structures and products made from polymeric materials, as well as give directions for the research and development of materials, any additional test methods of importance to fracture need to be added to the list. In line with such importance, in particular, a test method for evaluating the resistance to rapid crack propagation in terms of a material's ability to arrest the fast-running crack would be of interest for polymers.[1]-[4][10]-[12][14]

The value of the stress intensity factor, K, during the short time interval in which a fast-running crack arrests is a measure of the ability of materials to arrest such a crack. The values of the stress intensity factor of this kind, which are determined using the dynamic methods of analysis, provide a value for the crack-arrest fracture toughness, K_A. To ease complexity arising from the dynamic effects, static methods of analysis, which are much less complex, can often be used to determine the stress intensity factor at a short time (1 ms to 2 ms) after crack arrest. The estimate of the crack-arrest fracture toughness obtained in this fashion is termed K_a and the difference between K_A and K_a can be made small by minimizing the macroscopic dynamic effects during the test.[5]-[8] For cracks propagating under the conditions of crack-front plane-strain, in situations where the dynamic effects are also known to be small, K_{Ia} determinations using laboratory-sized specimens have been used successfully to estimate whether, and at what point, a crack arrests in a structure.[9]-[11] Depending upon the component design, the loading compliance, and the crack-jump length, a dynamic analysis of a fast-running crack propagation event can be necessary in order to predict whether crack arrest will occur and the arrest position. In such cases, values of K_{Ia}, determined by this International Standard can be used to identify those values of K below which the crack speed is zero. More details on the use of dynamic analyses can be found in Reference [8].

This International Standard describes a method for mode I plane-strain crack-arrest toughness measurement for polymers.