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Plastics — Evaluation of the adhesion interface performance in plastic-metal assemblies —

Part 5: Fracture energy

Plastiques — Évaluation des performances de l'interface d'adhérence dans les assemblages plastique-métal —

Partie 5: Énergie de rupture

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 61, *Plastics*, Subcommittee SC 11, *Products*.

A list of all parts in the ISO 19095 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user’s national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

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Introduction

There is a growing demand for reliability of metal-plastic joints to make lightweight cars and aircraft, which leads to fuel savings and reduced carbon dioxide emissions. Dissimilar joints of plastics and metals is also an important technology for manufacturing high-performance, low-cost electronic components.

Against this background of industrial trends, new bonding technologies are being developed and test methods for assessing the joint performance of metal-plastic assemblies manufactured in various bonding processes need to be standardized.

ISO 19095-1 through ISO 19095-4 were developed for the metal-plastic assemblies to assess the joint strength, sealing properties and environmental durability.

This document provides a test method to evaluate metal-plastic interfacial fracture energy and to characterize the failure behaviour of joints. This test is therefore useful for qualifying a joint's ability to resist fracture in order to ensure joint integrity.

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Plastics — Evaluation of the adhesion interface performance in plastic-metal assemblies —

Part 5: Fracture energy

SAFETY STATEMENT — Persons using this document should be familiar with normal laboratory practice, if applicable. This document does not purport to address all of the safety problems, if any, associated with its use. It is the responsibility of the user to establish appropriate safety and health practices. It is recognized that some of the materials permitted in this document might have a negative environmental impact. As technological advances lead to more acceptable alternatives for such materials, they will be eliminated to the greatest extent possible. At the end of the test, care should be taken to dispose of all waste in an appropriate manner.

1 Scope

This document specifies a method of testing the adhesion in plastic-metal joints produced by several techniques: adhesive bonding, direct joining of thermoplastics by injection or compression moulding, or other methods. More specifically this testing method provides a measure of the joint resistance to fracture in the region between plastic and metal adherends.

This method can only be used for comparing adhesives, surface treatments, bonding conditions and effects of environmental conditions. The results cannot be used for engineering design purposes.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 291, *Plastics — Standard atmospheres for conditioning and testing*

ISO 5893, *Rubber and plastics test equipment — Tensile, flexural and compression types (constant rate of traverse) — Specification*

ISO 10365, *Adhesives — Designation of main failure patterns*

ISO 17212, *Structural adhesives — Guidelines for the surface preparation of metals and plastics prior to adhesive bonding*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

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3.1
energy to initiate fracture
W_F
total input energy needed to bring the test specimen up to fracture initiation

Note 1 to entry: It is expressed in joules, J.

Note 2 to entry: W_F is determined from the load-displacement curve recorded during the test, by integration, as specified in Clause 6.

3.2
fracture energy
w_F
energy per unit width of the joining area (e_1)

$$w_F = W_F/e_1$$

Note 1 to entry: It is expressed in joules per metre, J/m.

3.3
precrack
non-adhering part of the adjacent faces the two adherends of the joint, acting as a crack initiator

3.4
precrack length
a_1
length of the *precrack* (3.3) in the longitudinal direction of the joint

Note 1 to entry: As specified in Figure 1.

Note 2 to entry: It is expressed in metres, m.

3.5
'nominal crack' length (before fracture)
a
distance from the load line (i.e. the line through the centres of the holes for the insertion of the loading pins) to the tip of the *precrack* (3.3)

Note 1 to entry: As specified in Figure 2.

Note 2 to entry: lt is expressed in metres, m.

4 Test specimens

4.1 Shape and size

Test specimens shall be prepared according to Figure 1. Metal and plastic plates having a thickness of 2,0 mm ± 0,1 mm, length w and width e_1, are joined in such a way as to leave a part of the two plates on one side of the laminate (hatched area in Figure 1, top) not bonded. This part will serve as a precrack, with length a_1. Specimen dimensions are as specified in Figure 1.

To apply the load to the test specimen, load blocks are tightly bonded to both sides of the plastic-metal laminate in accordance with the geometry as specified in Figure 2.

The length, a, of the 'nominal crack' should preferably be in the range $0{,}45 < a/W < 0{,}55$, and the specimen width, e_1, is preferably equal to $W/2$.

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