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**Test method for mode III interlaminar fracture toughness of
fiber-reinforced plastic composites**

纤维增强塑料复合材料III型层间断裂韧性的测定

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Foreword

This document complies with the provisions of GB/T 1.1-2020 "Standardization Work Guidelines Part 1: Structure and Drafting Rules of Standardization Documents". Drafting.

Please note that some content in this document may involve patents. The issuing organization of this document assumes no responsibility for identifying patents.

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This document was drafted by: Hebei University of Technology, Beijing University of Aeronautics and Astronautics, China Ordnance Industry Navigation and Control Technology Research Institute, and China Aerospace Science and Technology Corporation.

Institute of Mechanical Strength, Tianjin Aishida New Materials Technology Co., Ltd., Ningbo Institute of Materials Technology and Engineering, Chinese Academy of Sciences, Beijing Institute of Fiberglass Testing Center Co., Ltd., Chongqing University, Beijing Fiberglass Research and Design Institute Co., Ltd.

The main drafters of this document are: Zhao Libin, Gao Yuan, Liu Fengrui, Jia Ruodi, Yang Shengchun, Liu Qian, Zhu Yingdan, Yang Dexu, Wang Suian, and Gong Yu.

Song Guibin, Han Yu, Xu Haibing, Yu Zongzhi, Zhang Zheyi.

Fiber-reinforced plastic composites type III interlaminar Determination of fracture toughness

1 Scope

This document describes the principle, sample, and method for determining the Type III interlaminar fracture toughness of fiber-reinforced plastic composites using the edge ring crack torsion method.

Test equipment, test conditions, test procedures, result calculation, and test report.

This document applies to the measurement of interlaminar fracture toughness of Type III fiber-reinforced plastic composite laminates prepared by prepreg autoclave molding process.

For fiber-reinforced composite laminate samples prepared by other molding processes, the same procedure applies.

2 Normative references

GB/T 1446

GB/T 3961

GB/T 28889

GB/T 38537

3 Terms and Definitions

The terms and definitions defined in GB/T 3961 and the following terms and definitions apply to this document.

3.1 Type III crack tearing mode

Tear fracture mode caused by torsional load parallel to the tangent direction of the crack leading edge face within the crack plane.

Note. Abbreviated as "Type III mode".

3.2 K_{III}

The magnitude of the stress field at the ideal crack tip under the Type III mode (3.1).

Note. The stress intensity factor is a function of force, crack length, and the shape and size of the specimen.

3.3 G_{IIIC}

The critical value of strain energy release rate when delamination cracks begin to propagate under the Type III mode (3.1).

Note 1. The strain energy release rate of type III is the rate of change of the strain energy of the specimen with crack propagation under type III mode.

Note 2. The unit is joules per square meter (J/m²).

4 Principles

By introducing circumferential pre-cracks through inserts, symmetrical and balanced composite laminate specimens with edge circumferential cracks were formed (as shown in Figure 1).

(See diagram). A torsion testing machine was used to clamp the specimen-fixture assembly. A type III delamination load was introduced through torsional loading, and the composite material was measured.

Type III interlaminar fracture toughness.

5.1 Sample shape and size

The schematic diagram of the specimen is shown in Figure 1. The specimen is a square (or circular) composite laminate of uniform thickness, and the side length (or diameter) a of the specimen is...

(120 ± 0.5) mm, the sample thickness should not exceed 10 mm for 2h. An insert prefabricated portion is introduced outside the circular central bonding area on the middle surface of the sample.

The layer has a central bonding area radius r of (25 ± 1) mm, and the thickness of the embedding should not exceed 10 μ m. The sample coordinate system is shown in Figure 2.

a) Front view of a square specimen b) Front view of a circular specimen

c) Top view of a square specimen d) Top view of a circular specimen
Index number explanation. 1 --- Embedded object; 2 --- Central bonding area;

a --- Sample side length or diameter;

r --- Radius of the central bonding area of the sample; $2h$ --- Sample thickness.

Figure 1 Schematic diagram of the sample