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Designation: D 3929 – 96$^{\epsilon 1}$

Standard Test Method for Evaluating Stress Cracking of Plastics by Adhesives Using the Bent-Beam Method[1]

This standard is issued under the fixed designation D 3929; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

ε[1] NOTE—Editorial changes were made throughout in June 1997.

1. Scope

1.1 This test method describes a procedure for determining the compatibility of adhesives with plastics based on whether the adhesive causes cracking of stressed samples.

1.2 Specimen configurations and test fixture designs are given.

1.3 This test method is suitable for products in the form of sheet or strip. It can also be used on injection molded tensile specimens or flexural bars.

1.4 The values stated in inch-pound units are to be regarded as the standard. The SI units given in parentheses are for information only.

1.5 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*

D 638 Test Method for Tensile Properties of Plastics[2]

D 790 Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials[2]

D 907 Terminology of Adhesives[2]

3. Terminology

3.1 *Definitions*—Many of the terms in this test method are defined in Terminology D 907.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *cracking, n*—a continuous localized failure of the plastic, leading to loss of structural integrity.

3.2.2 *crazing, n*—apparent fine cracks at or under the surface of a plastic.

3.2.2.1 *Discussion*—This is a form of localized yielding of the plastic due to the combined action of stress and an attacking medium. Initial crazing may be detectable only by inspection under magnification.

3.2.3 *failure, n*—an arbitrary point defined by the initial detection of cracks or crazes.

4. Summary of Test Method

4.1 This test method involves the qualitative determination of the compatibility of adhesives with plastics by observing the effect of adhesives applied in the liquid state on stressed plastic specimens. Bars of plastic are bent in a three-point loading fixture to cause a predetermined initial tensile stress on the surface of the bar. The liquid adhesive is then applied to the area of maximum stress which is checked periodically for crazing or cracking.

4.1.1 Due to the stress relaxation behavior of certain plastics, initial stress only can be determined and the stress level may decrease significantly during the course of the test.

5. Significance and Use

5.1 This test method is designed for obtaining a qualitative estimate of the compatibility of plastics and adhesives. Due to the many process variables associated with the fabrication of plastic parts, it is not possible to use this test as a substitute for compatibility tests on actual parts.

5.2 The detection of cracks or crazes may be determined with or without optical aid. Make comparisons only among tests employing crack detection methods of equivalent sensitivity.

6. Apparatus

6.1 *Test Fixtures*—Bent beam test fixtures (see Fig. 1)[3] are designed to place the specimen in three-point bending. The amount of deflection is adjustable as well as the loading span. Other fixtures may be used as long as specimen deflection is known.

[1] This test method is under the jurisdiction of ASTM Committee D-14 on Adhesives and is the direct responsibility of Subcommittee D14.40 on Adhesives for Plastics.

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[2] *Annual Book of ASTM Standards*, Vol 08.01.

[3] Detailed drawings are shown in Figs. 3-5. Also necessary to complete the test fixture are the following parts: 2 pieces at ¼by 1½-in. dowel pins and 2 pieces of ⁸⁄₃₂ by 1¼-in. socket head cap screws.

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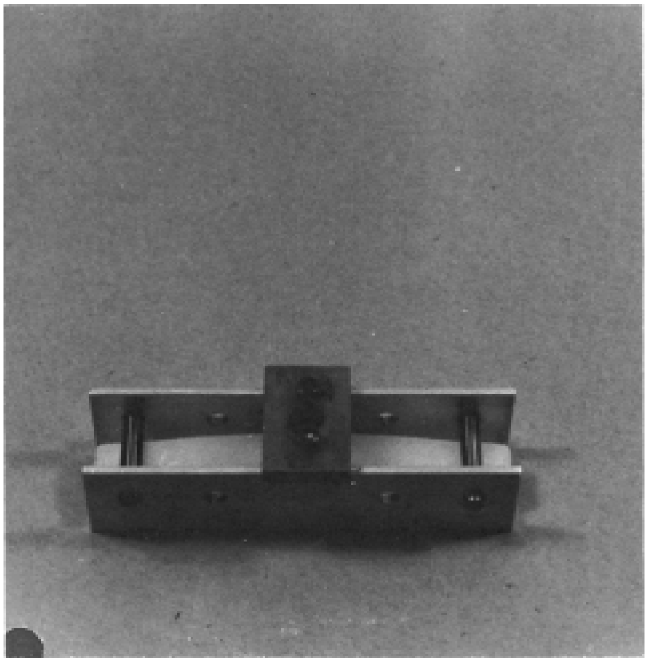

FIG. 1 Test Fixture with Plastic Bar in Place

6.2 The amount of deflection on the specimen is measured by use of a dial gage indicator or a vernier caliper having a depth indicator (see Fig. 2). Use a measuring device capable of reading to 0.001 in. (0.025 mm).

7. Test Specimen

7.1 The preferred specimen is a flexural bar designed in accordance with Test Methods D 790.

Depth	¼in. (6.4 mm)
Width	½in. (13 mm)
Length	5 in. (130 mm)
Loading Span	4 in. (100 mm)
L/d	16/1

Tensile bars, such as Type I in Test Method D 638, can also be used. Specimens of rectangular section may also be cut from sheets or molded plastic articles.

7.2 Mold specimens in a low-stress condition or anneal so that molded-in stresses will not have a significant effect.

7.3 Carefully cut or machine specimens in accordance with the plastic manufacturers' recommended procedures to avoid introducing stresses at machined surfaces.

8. Procedure

8.1 Place the plastic test specimen in the test fixture at the required loading (see Fig. 6).

8.2 Apply adhesive to be tested to the center point on the length of the loaded specimen. Cover a specimen length of approximately 1 in. (25 mm). In general, apply the adhesive only once, as would be the case in an actual end-use application.

8.2.1 If the adhesive contains a solvent, allow it to evaporate at a normal rate.

8.2.2 If the adhesive is a curing type, cure in a normal fashion.

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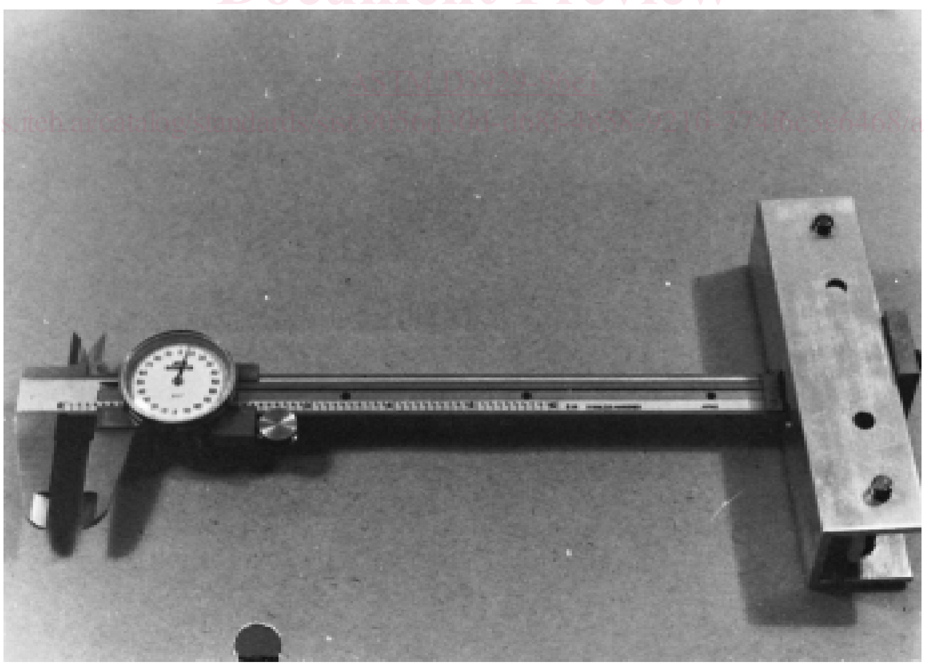

FIG. 2 Measurement of Test Bar Deflection with Depth Gage of Vernier Caliper