



Standard Test Method for Plastics: Dynamic Mechanical Properties: Cure Behavior¹

This standard is issued under the fixed designation D4473; 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.

This standard has been approved for use by agencies of the U.S. Department of Defense.

1. Scope

1.1 This test method covers the use of dynamic-mechanical-oscillation instrumentation for gathering and reporting the thermal advancement of cure behavior of thermosetting resin. It may be used for determining the cure properties of both unsupported resins and resins supported on substrates subjected to various oscillatory deformations.

1.2 This test method is intended to provide a means for determining the cure behavior of supported and unsupported thermosetting resins over a range of temperatures by free vibration as well as resonant and nonresonant forced-vibration techniques, in accordance with Practice D4065. Plots of modulus, tan delta, and damping index as a function of time/temperature are indicative of the thermal advancement or cure characteristics of a resin.

1.3 This test method is valid for a wide range of frequencies, typically from 0.01 to 100 Hz. However, it is strongly recommended that low-frequency test conditions, generally below 1.5 Hz, be utilized as they generally will result in more definitive cure-behavior information.

1.4 This test method is intended for resin/substrate composites that have an uncured effective elastic modulus in shear greater than 0.5 MPa.

1.5 Apparent discrepancies may arise in results obtained under differing experimental conditions. These apparent differences from results observed in another study can usually be reconciled, without changing the observed data, by reporting in full (as described in this test method) the conditions under which the data were obtained.

1.6 Due to possible instrumentation compliance, especially in the compressive mode, the data generated may indicate relative and not necessarily absolute property values.

1.7 Test data obtained by this test method are relevant and appropriate for use in engineering design.

1.8 The values stated in SI units are to be regarded as the standard.

1.9 *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.* Specific precautionary statements are given in Note 5.

NOTE 1—There is no known ISO equivalent to this standard.

2. Referenced Documents

2.1 ASTM Standards:²

D4000 Classification System for Specifying Plastic Materials

D4065 Practice for Plastics: Dynamic Mechanical Properties: Determination and Report of Procedures

D4092 Terminology for Plastics: Dynamic Mechanical Properties

ASTM/IEEE SI–10 Standard for Use of the International System of Units (SI): The Modern Metric System

3. Terminology

3.1 *Definitions*—For definitions applicable to this test method refer to Terminology D4092.

4. Summary of Test Method

4.1 A known amount of thermosetting liquid resin or resin-impregnated substrate is placed in mechanical oscillation at either a fixed or natural resonant frequency or by free vibration and at either isothermal conditions, with a linear temperature increase or using a time-temperature relation simulating a processing condition. The elastic or loss modulus, or both, of the composite specimen are measured in shear or compression as a function of time. The point in time when tan delta is maximum, and the elastic modulus levels off after an increase, is calculated as the gel time of the resin under the conditions of the test.

¹ This test method is under the jurisdiction of ASTM Committee D20 on Plastics and is the direct responsibility of Subcommittee D20.10 on Mechanical Properties.

Current edition approved Nov. 1, 2016. Published November 2016. Originally approved in 1985. Last previous edition approved in 2008 as D4473 - 08. DOI: 10.1520/D4473-08R16.

² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.