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Standard Test Method for LINEAR SHRINKAGE OF CURED THERMOSETTING CASTING RESINS DURING CURE¹

This standard is issued under the fixed designation D 2566; 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.

1. Scope

1.1 This test method² covers the measurement of the linear component of the shrinkage of thermosetting casting systems during cure.

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

1.3 *This standard may involve hazardous materials, operations, and equipment. This standard does not purport to address all of the safety problems 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 Document

2.1 ASTM Standard:

D618 Methods of Conditioning Plastics and Electrical Insulating Materials for Testing³

3. Significance and Use

3.1 The chemical reactions that occur when a thermosetting plastic composition undergoes its cure usually result in a contraction in volume of the reacting system. Some of this shrinkage may occur before the reacting system gels. The shrinkage measured in this test is that which occurs after gelation.

3.2 This shrinkage is the result of two effects—a change in specific volume, caused by the chemical cross-linking reaction, and a volume change as the cast material cools from its cure temperature or from its peak exothermic temperature. No attempt is made under conditions of this test to differentiate between these two effects.

3.3 The measurement of shrinkage is further complicated by the effects of the mold walls. As

the reacting liquid plastic system gives off heat, it normally expands. This expansion is confined by the mold walls. Most of the expansion must, therefore, take place toward the open side of the mold. When the peak exothermic temperature has passed, the solidifying plastic should shrink uniformly in all directions. However, at the time when the greatest shrinkage is occurring the partly solidified plastic fits closely to the sides of the mold. Friction prevents the free movement of the plastic over the mold surfaces. Therefore, the greatest shrinkage occurs perpendicular to the open surface of the mold.

3.4 In some cases, this irregular shrinkage can result in stresses set up in the cast plastic. These must, generally, be relieved by postcuring the casting at a temperature just below its glass transition temperature. The postcure usually results in further shrinkage as the stresses are relieved.

3.5 On the other hand, the design engineer and the user of the plastic casting are usually concerned only with deviations from mold dimensions. For a sufficiently large mold, it can be assumed that shrinkage perpendicular to surfaces other than the open side will be uniform and proportional to the distance over which the shrinkage occurs. Thus, the measurement of shrinkage between two parallel faces of a mold,

¹ This test method is under the jurisdiction of ASTM Committee D-20 on Plastics and is the direct responsibility of Subcommittee D20.16 on Thermosetting Materials.

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² This test method is similar to SPI-ERF 12-64, Method of Test for Linear Shrinkage of Epoxy Casting Resins During Cure. This method can be obtained from The Society of the Plastics Industry, Inc., 250 Park Ave., New York, NY 10017.

³ Annual Book of ASTM Standards, Vol 08.01.