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Thermosetting resin and UV curable resin — Determination of shrinkage by continuous measurement method

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ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

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Foreword

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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 12, *Thermosetting materials*.

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.

Introduction

The use of resin first requires curing it under specific conditions that vary depending on the product specification. During this curing process, chemical reactions occur and volatiles evaporate, and so the resin shrinks. This can cause defects, strength reduction, and the deformation of the finished parts or products, especially in high precision required applications.

The conventional method which measures the shrinkage of resin based on specific gravity requires long measurement time and an amount of resin about a few cubic centimetres. This sample size is larger than what is actually used in many applications such as the epoxy encapsulation compounds for integrated circuits, resin coating or adhesive for electronic devices. In order to improve the quality control and further promote the technical advancement of high precision production, a convenient and high accuracy method for determining the shrinkage of resin is essential.

A totally new measurement method has been developed to meet this demand, allowing to measure curing shrinkage continuously with just a trace amount of resin. Moreover, since measurements are taken continuously, the curing behaviour of resin such as thermal expansion and thermal contraction are also observed. This measurement method is described in this document.

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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 concerns, if any, associated with its use. It is the responsibility of the user to establish appropriate safety and health practices.

1 Scope

This document specifies the continuous measurement method of shrinkage for thermosetting resin and/or UV curable resin.

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 472, *Plastics — Vocabulary*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 472 and the following 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 http://www.electropedia.org/

3.1
UV curable resin
resin which is cured by receiving energy from UV rays

3.2
thermosetting resin
resin which is cured by receiving energy from heat

3.3
curing condition
UV irradiation and/or heating condition for curing resin

3.4
curing shrinkage
ratio of the change in resin volume due to curing process to the resin volume before curing

Note 1 to entry: Percentage of shrinkage due to curing of resin.

4 Principle

Cure the resin inside a sample container and continuously measure the changes of sample thickness. Since the horizontal cross-sectional area of resin sample remains constant due to the sidewalls of the sample container, the changes in sample volume are proportional to the changes in the sample