INTERNATIONAL STANDARD ISO 3521

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION • МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ • ORGANISATION INTERNATIONALE DE NORMALISATION

Plastics — Polyester and epoxy casting resins — Determination of total volume shrinkage

Matières plastiques — Résines de polyesters et d'époxydes coulées — Détermination du retrait global en volume

First edition — 1976-09-30

UDC 678.67 : 678.019.252

Ref. No. ISO 3521-1976 (E)

Descriptors : plastics, polyester resins, epoxy resins, castings, tests, determination, shrinkage.

Price based on 2 pages

FOREWORD

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Draft International Standards adopted by the Technical Committees are circulated to the Member Bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 3521 was drawn up by Technical Committee ISO/TC 61, *Plastics,* and was circulated to the Member Bodies in August 1974.

It has been approved by the Member Bodies of the following countries:

Belgium	Ireland	Spain
Brazil	Israel	Sweden
Chile	Netherlands	Switzerland
Czechoslovakia	New Zealand	Turkey
France	Poland	United Kingdom
Germany	Portugal	U.S.A.
Hungary	Romania	U.S.S.R.
India	South Africa, Rep. of	

No Member Body expressed disapproval of the document.

Plastics — Polyester and epoxy casting resins — Determination of total volume shrinkage

1 SCOPE AND FIELD OF APPLICATION

This International Standard specifies a method for determining the total volume shrinkage of polyester and epoxy casting resins.

2 PRINCIPLE

The density of the casting resin is determined

a) at the moment of mixing the components at the reaction temperature, but excluding reactive initiators (see note 1 in 5.1.2) in the measurement for unsaturated polyester resins;

b) after curing and conditioning to 23 °C.

The total volume shrinkage is calculated from the percentage change in density.

For components reacting at elevated temperatures, the density at the moment of mixing is determined by making buoyancy measurements of a sinker introduced into the reaction mixture over a period of time and extrapolating to zero time. For components reacting at room temperature, the density at the moment of mixing is determined by calculation from the individual densities at 23 °C.

The density after curing is determined, at 23 °C, by buoyancy measurements of a casting of the resin in silicone oil.

3 DEFINITION

For the purpose of this International Standard, the following definition applies :

total volume shrinkage of a resin compound : The sum of the shrinkage during curing of the resin compound and the shrinkage of the cured casting during the cooling from curing temperature down to room temperature.

4 APPARATUS

4.1 Balance, having an accuracy of ± 0,001 g, and fitted with a **device for measuring density** (preferably a high-speed balance with a wide range on a projected scale).

4.2 Sinker, of mass 25 ± 5 g, of known volume and coefficient of expansion at curing and room temperatures.

4.3 Thermostatically controlled bath of silicone oil of known density at curing and room temperatures.

4.4 Test tube, of length about 180 mm, and diameter 20 mm.

5 PROCEDURE

5.1 Determination of density of resin compounds that cure at temperatures higher than room temperature

Determine the mass of the sinker by weighing in air. Determine its exact volume at the curing temperature by a buoyancy method using silicone oil. Determine the mass of the suspension wire by weighing in air.

5.1.1 *Epoxy resins*

Heat the components of the resin compound separately to the reaction temperature and then mix, taking the moment of mixing of the components as zero time. Immediately after mixing, pour the mixture into the test tube. Then suspend the sinker (preheated to the curing temperature) in the resin compound and determine the apparent mass of the sinker, including the suspension wire, as a function of time (the measuring period depends on the resin compound to be investigated, and is usually about 1 h).

From the values obtained, determine graphically the apparent mass of the sinker, including the suspension wire, at zero time.

5.1.2 *Unsaturated polyester resins* (see note 2)

Mix the non-reacting (see note 1) resin components together and heat to the reaction temperature. Pour the mixture into the test tube. Then suspend the sinker (preheated to the curing temperature) in the non-reacting resin compound and determine the apparent mass of the sinker, including the suspension wire.

NOTES

1 Initiators used for curing unsaturated polyester resins, which are normally peroxide compounds, should not be heated, because of the danger of explosion.

2 As the level of initiator used in unsaturated polyester resin is small (1 to 2 %), the density of the liquid polyester resin, without initiator, is sufficiently accurate.