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Glass — Viscosity and viscometric fixed points —

Part 4 :
Determination of viscosity by beam bending

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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. They are approved in accordance with ISO procedures requiring at least 75 % approval by the member bodies voting.

International Standard ISO 7884-4 was prepared by Technical Committee ISO/TC 48, *Laboratory glassware and related apparatus*.

Users should note that all International Standards undergo revision from time to time and that any reference made herein to any other International Standard implies its latest edition, unless otherwise stated.

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Glass — Viscosity and viscometric fixed points —

Part 4 : Determination of viscosity by beam bending

0 Introduction

International Standard ISO 7884, *Glass — Viscosity and viscometric fixed points*, consists of the following separate parts:

Part 1: Principles for determining viscosity and viscometric fixed points.

Part 2: Determination of viscosity by rotation viscometers.

Part 3: Determination of viscosity by fibre elongation viscometer.

Part 4: Determination of viscosity by beam bending.

Part 5: Determination of working point by sinking bar viscometer.

Part 6: Determination of softening point.

Part 7: Determination of annealing point and strain point by beam bending.

Part 8: Determination of (dilatometric) transformation temperature.

1 Scope and field of application

This part of ISO 7884 specifies a method of determining the dynamic viscosity of glass on a rod-shaped test specimen (called a beam) supported at its ends. The viscous deflection rate of the beam is measured under a given load at the midpoint between the supports. In addition the viscosity-temperature relationship and the dependence of the viscosity on the thermal history of the sample can be determined.

The viscosity range covered by this method extends from 10^9 to 10^{15} dPa·s*, corresponding to measuring temperatures between about 900 and 400 °C for all glasses of normal bulk-production compositions.

The procedures are limited to small deflections and to small deflection rates (see 3.6).

NOTE — During beam bending, elongation flows of both signs occur (zero passage within the neutral plane). The determination of shear viscosity is possible only with Newtonian or linear-viscoelastic behaviour of the glass. The procedures are sensitive to interference by devitrification of the sample. With viscosities above 10^{12} dPa·s the adjustment of the structure equilibrium within the glass is perceptibly delayed with respect to the temperature setting. For tests within this range it should be agreed whether it is necessary to wait for the final equilibrium viscosity at a given temperature or to take the viscosity value corresponding to a conventional temperature-time programme (see 6.3).

* $1\ \text{dPa·s} = 1\ \frac{\text{dN·s}}{\text{m}^2} = 1\ \text{P}$

(P is the symbol for poise)

2 Reference

IEC Publication 584-1, *Thermocouples — Part 1: Reference tables.*

3 Principle

3.1 Beams

For this test procedure, rod-shaped test specimens, called beams, are prepared from the sample. Along their length l they have a constant cross-sectional area (see figure 1) which may be

a) rectangular, of thickness h, and width b;

b) circular, of diameter d.

3.2 Supports, span

The beam is placed horizontally on two supports; the beam axis and the supports are perpendicular.

For rectangular cross-section beams the supports are horizontal and have straight edges.

For circular cross-section beams the support edges may be semi-circles or notches.

The distance l_S between the supports is called the span. The beam juts out only little beyond the supports, satisfying equation (1):

$$1{,}1 \leqslant \frac{l}{l_S} \leqslant 1{,}15 \qquad \ldots (1)$$