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JAPANESE INDUSTRIAL STANDARD

Testing Methods for Transition Temperatures of Plastics

JIS K 7121—1987

Translated and Published

by

Japanese Standards Association

Printed in Japan

In the event of any doubt arising,
the original Standard in Japanese is to be final authority.

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Testing Methods for Transition
Temperatures of Plastics

K 7121-1987

1. Scope

This Japanese Industrial Standard specifies the testing methods for transition temperatures (melting temperatures, crystallization temperatures, and glass transition temperatures) of plastics.

Remark: These methods may also be applied to the crystal-crystal transition temperatures of plastics and various transition temperatures of plastics which form liquid crystal, as appropriate.

2. Definitions

The definitions of the main terms used in this Standard shall be as follows except as specified in JIS K 6900.

- (1) differential thermal analysis (DTA) A method of measuring the difference in temperature between the test specimen and the reference substance as a function of temperature while varying the temperatures of the test specimen and the reference substance according to a controlled programme.

In this case, the reference substance consists of a vacant receptacle or a receptacle charged with α -alumina.

- (2) DTA curve A curve drawn in differential thermal analysis by taking the temperature difference on the axis of ordinate and the temperature or time on the axis of abscissa.

- (3) differential scanning calorimetry (DSC) The general term for the following two measuring methods:

- (a) power compensation differential scanning calorimetry (power-compensation DSC) A method of measuring the difference in the input of thermal energy per unit time applied to the test specimen and the reference substance as a function of temperature so as to equalize their temperatures while varying their temperatures according to a controlled programme.

Applicable Standards:

JIS K 6900-Glossary of Terms Used in Plastic Industry

JIS K 7100-Standard Atmospheres for Conditioning and Testing of Plastics

JIS Z 8401-Rules for Rounding off of Numerical Values

Corresponding International Standard:

ISO 3146-Plastics-Determination of melting behaviour (melting temperature or melting range) of semi-crystalline polymers

Reference Standard:

ASTM D 3418-82-Standard Test Method for Transition Temperatures of
Polymers by Thermal Analysis

- (b) heat flux differential scanning calorimetry (heat flux DSC) A method of measuring the difference in temperature between the test specimen and the reference substance as a function of temperature while varying their temperatures according to a controlled programme.

In this measurement, the difference in temperature between the test specimen and the reference substance is proportional to the difference in the input of thermal energy per unit time.

- (4) DSC curve A curve drawn in differential scanning calorimetry by taking on the axis of ordinate the difference in the input of thermal energy per unit time applied to the test specimen and the reference substance so as to equalize their temperatures and taking the temperature or time on the axis of abscissa.
- (5) base line The part of a DTA curve or DSC curve in the temperature region where no transition nor reaction occurs in the test specimen.

Remark: In general cases, the curvature of the base line is equal to that of the DTA curve or DSC curve obtained when measuring with the vacant receptacle placed. In some cases, the curve can be regarded as a straight line in a narrow temperature region.

- (6) peak In a DTA curve or DSC curve, the part where the curve leaves the base line and then returns to the same base line.
- (7) stepped change In a DTA curve or DSC curve, the part where the curve leaves the former base line and shifts to a new base line.

Remark: A DTA curve or DSC curve in the part where a transition or reaction is taking place shows a form containing a peak, staged change, and their combinations.

- (8) peak height The distance measured vertically to the axis of abscissa between an interposed base line and the peak crest.

3. Conditioning of Test Specimen

The conditioning methods for test specimens shall be classified into the following three kinds according to the measuring methods.

- (1) For Measurement of Transition Temperatures by Conditioning under Standard Atmospheric Conditions The test specimen shall, as a rule, be conditioned before testing under the standard temperature condition grade 2 and the standard humidity condition grade 2 (temperature, $23 \pm 2^\circ\text{C}$; relative humidity, $50 \pm 5\%$) specified in JIS K 7100 for 24 hours or longer. However, conditioning may be made by the method agreed upon between the parties concerned.
- (2) For Measurement of Melting Temperature after a Definite Heat Treatment After the conditioning of (1), the test specimen shall be melted by heating to a temperature about 30°C higher than that at the end of the melting peak in the receptacle of DSC or DTA apparatus and after being maintained at the same temperature for 10 minutes, cooled to a temperature about 50°C lower than that at the appearing transition peak at a cooling rate of 5°C or 10°C per minute (refer to 8.6).