INTERNATIONAL STANDARD

ISO 289-3

Second edition
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Rubber, unvulcanized — Determinations using a shearing-disc viscometer —

Part 3: Determination of the Delta Mooney value for non-pigmented, oil-extended emulsion-polymerized SBR

Caoutchouc non vulcanisé — Déterminations utilisant un consistomètre à disque de cisaillement —

Partie 3: Détermination de la valeur Delta Mooney pour le caoutchouc styrène-butadiène polymérisé en émulsion, étendu à l'huile, non pigmenté

Reference number
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ISO copyright office
Ch. de Blandonnet 8 • CP 401
CH-1214 Vernier, Geneva, Switzerland
Tel. +41 22 749 01 11
Fax +41 22 749 09 47
copyright@iso.org
www.iso.org

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

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).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information.

The committee responsible for this document is ISO/TC45, *Rubber and rubber products*, Subcommittee SC 2, *Testing and analysis*.

This second edition cancels and replaces the first edition (ISO 289-3:1999), which has been technically revised to update normative references and to provide a reference to the latest calibration information.

ISO 289 consists of the following parts, under the general title *Rubber, unvulcanized — Determinations using a shearing-disc viscometer*:

— *Part 1: Determination of Mooney viscosity*

— *Part 2: Determination of pre-vulcanization characteristics*

— *Part 3: Determination of the Delta Mooney value for non-pigmented, oil-extended emulsion-polymerized SBR*

— *Part 4: Determination of the Mooney stress-relaxation rate*

Introduction

The Delta Mooney value provides a means of predicting the behaviour or processibility of rubber during the primary stages of mixing, extruding, and calendering. It is usually associated with non-pigmented, oil-extended emulsion styrene-butadiene rubber, but it can be of use in providing information about the behaviour of other types. In the latter case, however, the conditions of test specified in this part of ISO 289 might not be suitable.

Rubber, unvulcanized — Determinations using a shearing-disc viscometer —

Part 3:
Determination of the Delta Mooney value for non-pigmented, oil-extended emulsion-polymerized SBR

WARNING — Persons using this part of ISO 289 should be familiar with normal laboratory practice. This part of ISO 289 does not purport to address all of the safety problems, if any, associated with its use. It is the responsibility of the user to establish appropriate safety and health practices and to ensure compliance with any national regulatory conditions.

1 Scope

This part of ISO 289 specifies a method for determining the Delta Mooney value of non-pigmented, oil-extended emulsion-polymerized styrene-butadiene rubber.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 289-1, *Rubber, unvulcanised — Determinations using a shearing-disc viscometer — Part 1: Determination of Mooney viscosity*

ISO 1795, *Rubber, raw natural and raw synthetic — Sampling and further preparative procedures*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1

Delta Mooney A values

NOTE A "massed test sample" is referred to as a "homogenized test sample" in ISO 1795. Similarly, an "unmassed test sample" can be described as an "unhomogenized test sample".

3.1.1
A1 value
difference between the Mooney viscosities of an unmassed test sample recorded at 15 min and 1 min, i.e. ML(1+15) – ML(1+1)

3.1.2
A2 value
difference between the Mooney viscosities of an unmassed test sample recorded at 7 min and 1 min, i.e. ML(1+7) – ML(1+1)

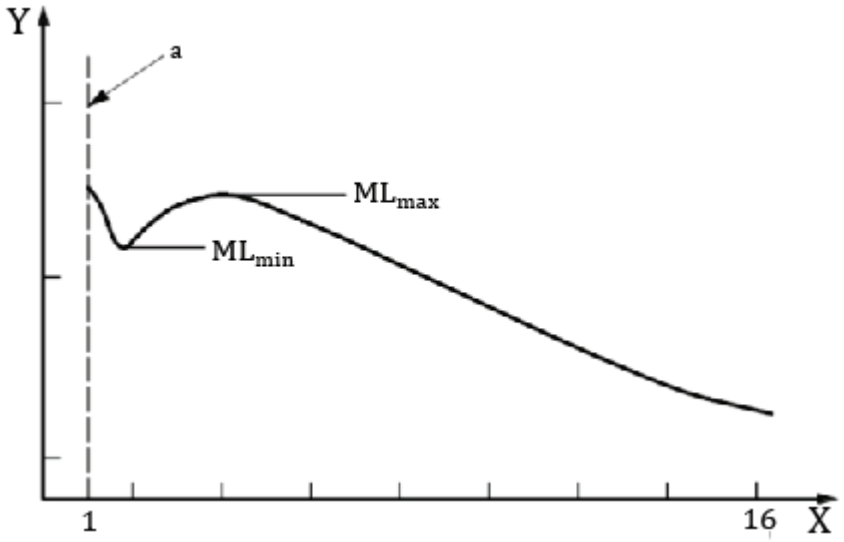
3.1.3
A3 value
difference between the Mooney viscosities of a massed test sample recorded at 15 min and 1,5 min, i.e. ML(1+15) – ML(1+1,5)

3.2
Delta Mooney B value
difference between the minimum Mooney viscosity soon after starting the rotor and the subsequent maximum Mooney viscosity for an unmassed test sample

Note 1 to entry: The values are complementary and any combination may be used to assist in distinguishing those rubbers that are easy to process from those that process with significantly greater difficulty.

4 Principles

The test consists of determining the difference between the Mooney viscosity values at two specified times (Delta Mooney A) or at two specified points on the curve of Mooney viscosity against time (Delta Mooney B), see Figure 1.



Key
X time, min
Y Mooney viscosity
a Rotor started.

Figure 1 — Mooney viscosity plot

5 Apparatus

The test apparatus shall be as specified in ISO 289-1.

6 Calibration

The test apparatus shall be calibrated according to ISO 289-1.

7 Preparation of test piece

Ensure that the unmassed test sample is free from entrapped air and that the surface is smooth and regular, thereby avoiding air entrapment between the test piece and the rotor or die surfaces. This may be achieved by compacting the test sample in a mould for 5 min at 23 °C ± 2 °C, followed by a relaxation period of 15 min.

The massed ("homogenized") test sample shall be prepared according to ISO 1795.

The test piece shall be prepared from the test sample according to ISO 289-1.

8 Test temperature

The test temperature shall be 100 °C ± 0,5 °C, this being the temperature of the closed dies with the rotor in place and the cavity empty.

9 Procedure

The test shall be conducted according to the procedure described in ISO 289-1, using the large rotor, a preheating time of 1 min and a running time of either 7 min or 15 min.

If the viscosity has not been recorded continuously, plot the observed Mooney viscosity values as specified in ISO 289-1.

NOTE An automatic recorder is strongly recommended.

10 Calculation and expression of results

The Delta Mooney A1 value shall be determined as the difference between the Mooney viscosities recorded at running times of 15 min and 1 min.

The Delta Mooney A2 value shall be determined as the difference between the Mooney viscosities recorded at running times of 7 min and 1 min.

The Delta Mooney A3 value shall be determined as the difference between the Mooney viscosities recorded at running times of 15 min and 1,5 min.

The Delta Mooney B value shall be determined as the difference between the minimum and maximum Mooney viscosities (see Figure 1).

NOTE For Delta Mooney A, lower (in most cases, more negative) values are indicative of easier-processing rubbers. For Delta Mooney B, lower values also indicate easier processing.

11 Test report

The test report shall include the following information:

a) all details necessary for complete identification of the rubber tested, including whether the test sample was compacted or not;

b) full reference to the test method used, reference to this part of ISO 289 (i.e. ISO 289–3);

c) test detail:

   1) model of viscometer used and name of the manufacturer;

   2) details of any procedures not specified in this part of ISO 289;

   3) details of any procedure not included in this part of ISO 289, as well as any operation regarded as optional;

d) test results:

   1) Delta Mooney A1, A2, A3 and/or B value;

e) date(s) of the test.

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Price based on 3 pages