INTERNATIONAL STANDARD

**ISO 3136**

Third edition
2023-05

# Rubber latex — Styrene-butadiene — Determination of bound styrene content

*Latex de caoutchoucs — Styrène-butadiène — Détermination de la teneur en styrène lié*



Reference number
ISO 3136:2023(E)



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

Published in Switzerland

# Contents

Page

# 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 document 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).

ISO draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). ISO takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, ISO had not received notice of (a) patent(s) which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at www.iso.org/patents. ISO shall not be held responsible for identifying any or all such patent rights.

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

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 45, *Rubber and rubber products*, Subcommittee SC 3, *Raw materials (including latex) for use in the rubber industry*.

This third edition cancels and replaces the second edition (ISO 3136:1983), which has been technically revised.

The main changes are as follows:

— the mandatory Terms and definitions clause (Clause 3) has been added and the subsequent clauses have been renumbered;

— the former reagents and apparatus clause has been split into Clauses 5 and 6, respectively;

— the preparation of dry polymer has been moved to a new Clause 8 and the determination of the refractive index to a new Clause 9;

— the preparation procedure of dry polymer, in Clause 8 has been amended;

— Formula (1) has been added in the expression of result, in Clause 10;

— the precision data has been added in a new Annex A.

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.

# Rubber latex — Styrene-butadiene — Determination of bound styrene content

**WARNING — Persons using this document should be familiar with normal laboratory practice. This document 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 determine the applicability of any other restrictions.**

**WARNING — Certain procedures specified in this document possibly involves the use or generation of substances, or the generation of waste, that can constitute a local environmental hazard. Reference should be made to appropriate documentation on safe handling and disposal after use.**



## 1 Scope

This document specifies a method for the determination of the bound styrene content of styrene-butadiene rubber (SBR) lattices.

The method is applicable to hot (approximately 50 °C) emulsion polymerized SBR lattices having a bound styrene content, expressed on the SBR content, of up to 55 % and to cold (approximately 5 °C) emulsion polymerized SBR lattices having a bound styrene content between 18 % and 40 %.

The method is not applicable to reinforced styrene-butadiene rubber (SBR. .Y) lattices, carboxylic-styrene-butadiene rubber (XSBR) lattices and pyridine-styrene-butadiene rubber (PSBR) lattices.

## 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 123, *Rubber latex — Sampling*

ISO 2028, *Synthetic rubber latex — Preparation of dry polymer*

ISO 2453, *Rubber, raw styrene-butadiene, emulsion-polymerized — Determination of bound styrene content — Refractive index method*

## 3 Terms and definitions

No terms and definitions are listed in this document.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

## 4 Principle

A dry polymer is prepared from the latex and then extracted with ethanol-toluene azeotrope (ETA), followed by pressing into a thin sheet. The bound styrene content is calculated from the refractive index obtained at 25 °C on this sheet.

## 5 Reagents

Use reagents specified in ISO 2028 and ISO 2453.

## 6 Apparatus

Use the apparatus specified in ISO 2028 and ISO 2453.

## 7 Sampling

Carry out sampling in accordance with one of the methods specified in ISO 123.

## 8 Preparation of dry polymer

In accordance with ISO 2028, coagulate the latex with appropriate coagulants in the presence of antioxidant, followed by collecting and drying the resultant crumb.

## 9 Determination of the refractive index

In accordance with ISO 2453, sheet out the dry polymer, followed by extracting with ETA and drying, finally press into a thin sheet and determine the refractive index.

## 10 Expression of results

The bound styrene content, $w_s$, of the SBR lattices, expressed as a percentage mass fraction, is determined from the refractive index, corrected to 25 °C, by using Formula (1) or according to ISO 2453:2020, Table 1.

$$w_s = 23{,}50 + 1\ 164(n_{25} - 1{,}534\ 56) - 3\ 497(n_{25} - 1{,}534\ 56)^2 \quad (1)$$

where $n_{25}$ is the refractive index at 25 °C.

## 11 Precision

See Annex A.

## 12 Test report

The test report shall include the following information:

a) a reference to this document, i.e. ISO 3136:2023;

b) all details necessary for the complete identification of the sample;

c) the coagulants used;

d) the results and the method of expression used;

d) any unusual features noted during the determination;

f) details of any operation not included in this document or in the International Standards to which reference is made, as well as details of any operation regarded as optional;

g) the date of the test.

# Annex A
(informative)

# Precision

## A.1 General

An interlaboratory test programme (ITP) on the basis of styrene-butadiene rubber lattices polymerized at 5 °C was conducted in June 2022. The precision evaluated was a type 1 precision in accordance with ISO 19983:2022.

Nine laboratories participated in this programme. Two different types of rubber lattices were used in the ITP. The dry polymers were prepared in one laboratory and posted to other participated laboratories. Each laboratory repeated the tests twice for each sample on two different days at intervals of one week.

The precision results as determined by this ITP should not be applied to acceptance or rejection testing of any group of materials or products without documentation that the results of this precision evaluation actually apply to the products or materials tested.

## A.2 Precision results

The precision results in Table A.1 were calculated using method B of ISO 19983:2022.

a) Repeatability: the day-to-day repeatability, $r_D$, of the test method has been established as the appropriate value tabulated in Table A.1 for each material. Two single test results that differ by more than this value should be considered suspect and suggest that some appropriate investigative action be taken.

b) Reproducibility: the reproducibility, $R$, of the test method has been established as the appropriate value tabulated in Table A.1 for each material. Two single test results that differ by more than this value should be considered suspect and suggest that some appropriate investigative action be taken.

**Table A.1 — Precision data**

| Material | Mean content | Within laboratory day-to-day | | | Between laboratories | | | Number of laboratories [a] |
|---|---|---|---|---|---|---|---|---|
| | % | $s_D$ | $r_D$ | $(r_D)$ | $s_R$ | $R$ | $(R)$ | |
| SBR latex-1 | 23,30 | 0,14 | 0,40 | 1,72 | 0,23 | 0,65 | 2,79 | 9 |
| SBR latex-2 | 40,59 | 0,19 | 0,54 | 1,33 | 0,27 | 0,76 | 1,87 | 8 |

$s_D$ is the day-to-day repeatability standard deviation;

$r_D$ is the day-to-day repeatability, in measurement units;

$(r_D)$ is the relative day-to-day repeatability, in percent;

$s_R$ is the reproducibility standard deviation;

$R$ is the reproducibility, in measurement units;

$(R)$ is the relative reproducibility, in percent.

[a] The final number of laboratories in the ITP after deletion of outliers.

# Bibliography

[1] ISO 19983:2022, *Rubber — Determination of precision of test methods*