International Standard 2930

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Rubber, raw natural — Determination of plasticity retention index (PRI)

Caoutchouc naturel brut — Détermination de l'indice de rétention de plasticité (PRI)

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards institutes (ISO member bodies). The work of developing International Standards is carried out through ISO technical committees. Every member body interested in a subject for which a technical committee has been set up 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.

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 2930 was developed by Technical Committee ISO/TC 45, *Rubber and rubber products.*

This second edition was submitted directly to the ISO Council, in accordance with clause 5.10.1 of part 1 of the Directives for the technical work of ISO. It cancels and replaces the first edition (i.e. ISO 2930-1975), which had been approved by the member bodies of the following countries :

Australia	Hungary	Romania
Austria	India	South Africa, Rep. of
Belgium	Italy	Sri Lanka
Brazil	Malaysia	Sweden
Bulgaria	Mexico	Switzerland
Canada	Netherlands	Thailand
Czechoslovakia	New Zealand	United Kingdom
Egypt, Arab Rep. of	Poland	USA
France	Portugal	

No member body had expressed disapproval of the document.

Rubber, raw natural — Determination of plasticity retention index (PRI)

1 Scope and field of application

This International Standard specifies a method for determining the plasticity retention index (PRI) of raw natural rubber.

The plasticity retention index (PRI) is a measure of the resistance of raw natural rubber to oxidation. It is an improvement over earlier tests in that a quantitative, as opposed to a visual, assessment of oxidation behaviour is obtained. A high resistance to oxidation is shown as a high value of the index.

2 References

ISO 1796, *Rubber, raw — Sample preparation.*

ISO 2007, *Rubber, unvulcanized — Determination of plasticity — Rapid plastimeter method.*

ISO 2393, *Rubber test mixes — Preparation, mixing and vulcanization — Equipment and procedures.*

3 Principle

Determination of the rapid plasticity numbers on unaged test pieces and test pieces aged by heating in an oven at 140 °C, using the parallel plate plastimeter with a platen 10 mm in diameter, and following the procedure specified in ISO 2007.

The PRI is the ratio of the rapid plasticity numbers after and before heating multiplied by 100.

4 Apparatus

4.1 Parallel plate plastimeter, with a platen 10 mm in diameter, and **punch** for preparation of test pieces, as specified in ISO 2007.

4.2 Thickness gauge, having a scale graduated in unit divisions of 0,01 mm, fitted with a flat contact of diameter about 4 mm, and operating with a pressure of 20 ± 3 kPa.

4.3 Laboratory mixing mill, in conformity with the requirements of ISO 2393.

4.4 Oven, capable of the following performance at 140 °C :

— *control of the temperature in the vicinity of the test pieces to be within* ± 0,2 °C over a 30 min period;

NOTE — A larger tolerance will impair the accuracy of test.

— allowing temperature recovery of the oven and the inserted tray and dishes to within 1 °C of the set temperature in a time not exceeding 2 min after insertion of the tray in the oven;

— changing the air ten times per hour.

NOTE — Ovens designed to achieve this performance are commercially available.

4.5 Lightweight disposable aluminium dishes and tray.

Suitable dishes have a thickness of 0,2 mm and a diameter of 40 to 50 mm. Any dishes and trays used shall have low thermal capacity; the total mass of the tray and dishes shall not exceed 35 g, and their volume shall not exceed 5 % of the volume of the oven chamber.

5 Procedure

5.1 Test piece

Homogenize the raw rubber as specified in ISO 1796. Take a test portion of about 30 g from the homogenized piece and pass three times (doubling the sheet between passes) between the rolls of the mill (4.3) at ambient temperature, running with the nip adjusted so that the final sheet thickness is about 1,7 mm. Immediately double the sheet, which shall be uniform in texture and free from holes, and lightly press the two halves together by hand, avoiding the formation of air bubbles.

Cut test pieces as specified in ISO 2007 from the doubled sheet with the punch (4.1) and measure their thicknesses with the gauge (4.2) until six test pieces are obtained with thicknesses between 3,2 and 3,6 mm. Randomly divide these into sets of three, one set for test before ageing and the other for test after ageing.

The preparation of test pieces, as described above, shall be carried out with care, since the PRI is affected by the sheet thickness. The required nip setting shall be ascertained by a preliminary trial; it will vary with the rubber and with the mill. If six test pieces of the required thicknesses as above are not obtained, a fresh doubled sheet shall be prepared.

5.2 Ageing

Before ageing is started, check the temperature of the oven (4.4) to ensure that it has been stable for at least 5 min.

NOTE — To ensure that all test pieces are aged at the correct temperature, the oven must not be overloaded; this may cause a severe prolonged drop and may upset temperature uniformity (see 4.5).

Quickly insert the tray (4.5), close the oven door and start timing. Care shall be taken that the dishes and tray are arranged within the calibrated region of the oven. Check that the correct temperature is quickly regained and retained.

After 30 ± 0,25 min, remove the tray from the oven and the dishes from the tray. Allow them to cool to ambient temperature.

5.3 Determination of plasticity

Carry out the rapid plasticity determination as specified in ISO 2007, using the 10 mm platen.

These determinations shall normally be made at least 0,5 h and not more than 2 h after ageing, with the proviso that the test pieces have been allowed to cool to ambient temperature. Plasticity determinations on unaged and aged test pieces should preferably be made concurrently. The paper used shall conform to clause 7 of ISO 2007, and the rapid plasticity number shall be read to the nearest 0,5 unit.

6 Calculation of result

The median values for the rapid plasticity numbers of the three unaged and three aged test pieces shall be used to calculate the PRI, using the formula

$$\text{PRI} = \frac{\text{aged rapid plasticity number}}{\text{unaged rapid plasticity number}} \times 100$$

7 Repeatability of results

The coefficient of variation V is dependent on the accuracy of the ageing temperature. For PRI calculated as in clause 6 from the median plasticity values, V is 3 % when ageing at 140 ± 0,2 °C and ± 6 % at 140 ± 1 °C. Both values of V are consistent with an accuracy of ± 3 % for single determinations of rapid plasticity number.

8 Test report

The test report shall include the following particulars :

a) a reference to this International Standard;

b) the sample identification including lot and bales;

c) the median rapid plasticity number for unaged and aged test pieces from each sample tested;

d) the PRI for each sample tested;

e) the type of oven used.