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International Standard 1399

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Rubber, vulcanized — Determination of permeability to gases — Constant volume method

Caoutchouc vulcanisé — Détermination de la perméabilité aux gaz — Méthode à volume constant

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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 1399 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 6.11.2 of part 1 of the Directives for the technical work of ISO. It cancels and replaces the first edition (i.e. ISO 1399-1976), which had been approved by the member bodies of the following countries :

Australia	Hungary	Spain
Austria	India	Sweden
Canada	Iran	Switzerland
Colombia	Israel	Thailand
Czechoslovakia	Italy	Turkey
Egypt, Arab Rep. of	Netherlands	United Kingdom
France	New Zealand	USSR
Germany, F. R.	Poland	

No member body had expressed disapproval of the document.

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Rubber, vulcanized — Determination of permeability to gases — Constant volume method

0 Introduction

The measurement of the permeability of rubber to permanent gases is important in the evaluation of rubbers for such products as inner tubes, tubeless tyre liners, hoses, balloons or other gas containers, or seals. The measurement is also of theoretical importance in the study of characteristics of diffusion and gas solubility in relation to polymer structure. The fundamental requirements of a permeability test for industrial use are accuracy, rapidity and good temperature control, combined with maximum simplicity in the assembly of the equipment.

1 Scope and field of application

This International Standard specifies a method for the determination of the permeability of vulcanized rubbers to gases.

2 Definition

For the purpose of this International Standard, the following definition applies.

permeability of rubber to gases : The rate of volume flow of gas under steady state conditions referred to standard temperature and pressure between opposite faces of a unit cube of solid rubber, when subjected to unit pressure difference and controlled temperature.

3 Apparatus (See figures 1 and 2)

3.1 Test cell, in which the test piece may be clamped round its periphery in a gas-tight manner so as to expose one surface to gas under pressure. The other surface of the test piece shall be supported against the force due to the gas pressure so that no deformation takes place. For this reason, the low-pressure side of the test cell shall be filled with a rigid, easily permeable packing piece which may consist of a disk of microporous ebonite or disks of fine wire gauze which completely fill the cavity. A means of indicating gas pressure up to about 500 kPa[1)] with an error of no more than 1 %, shall be connected to the high-pressure side of the cell.

The internal volume of the high-pressure side of the test cell shall be at least 25 cm^3 to minimize the pressure loss due to diffusion during a test which may last several hours.

The internal volume of the low-pressure (atmospheric) side of the test cell shall be kept to a minimum by the use of permeable packing as described above and by small diameter passages through the dismountable coupling and tubing to the manometer. For the design shown in figure 2, a total volume between test piece and datum mark of 1 to 2 cm^3 is typical.

The test cell shall be made of metal and shall be of sufficient mass to facilitate temperature stability; it shall be provided with a drilled pocket to hold a suitable temperature-measuring device.

3.2 Temperature-measuring device, accurate to 0,2 °C.

3.3 Manometer, consisting of a capillary tube of U shape, filled with a non-volatile liquid such as dioctyl sebacate which does not dissolve the gas, graduated on the long, straight, vertical portion and provided with a datum mark on the short portion close to the test cell.

The use of a microscope to observe the liquid level is advantageous.

A vertically adjustable reservoir of liquid shall be connected by a T-piece to the lowest portion of the manometer U-tube. A bypass valve shall be provided between the union and datum mark, to release gas for initial adjustments.

NOTE — An alternative means of measuring pressure, for example a transducer, may be used provided it is suitably calibrated and enables the procedure to be carried out in essentially the same manner.

3.4 Constant-temperature bath, or other means capable of maintaining the test cell at the required test temperature to within ± 0,5 °C. The wall of the bath shall be arranged so that the outlet from the test cell will project through the side, leaving the dismountable coupling accessible. A number of test cells containing different test pieces may then be connected in turn to a single manometer apparatus.

1) 1 kPa = 1 kN/m^2