
International Standard



4638

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Polymeric materials, cellular flexible — Determination of air flow permeability

Matériaux polymères alvéolaires souples — Détermination de la perméabilité à l'air

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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 developing International Standards is carried out through ISO technical committees. Every member body interested in a subject for which a technical committee has been authorized 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 4638 was developed by Technical Committee ISO/TC 45, *Rubber and rubber products*, and was circulated to the member bodies in February 1982.

It has been approved by the member bodies of the following countries :

Austria	Germany, F.R.	Romania
Belgium	India	South Africa, Rep. of
Brazil	Indonesia	Spain
Canada	Ireland	Sri Lanka
China	Mexico	Thailand
Czechoslovakia	Netherlands	Turkey
Denmark	Nigeria	USA
Egypt, Arab Rep. of	Poland	USSR
France	Portugal	

The member body of the following country expressed disapproval of the document on technical grounds :

United Kingdom

Polymeric materials, cellular flexible — Determination of air flow permeability

0 Introduction

The air flow permeability of cellular materials indicates, in an indirect manner, some of their structural properties. It may be used to establish correlations between the structure of these materials and some of their physical properties. It also enables identification of the modifications to cellular structures produced by chemical agents used in foaming, for example catalysts or surfactants.

This International Standard is, therefore, useful for two purposes:

- a) in studying the structure of cellular products in connection with their physical properties and their method of manufacture;
- b) in ensuring product quality (quality assurance).

NOTE — Details of publications relating to flow behaviour in both laminar and turbulent conditions are given in a bibliography.

1 Scope and field of application

This International Standard specifies a method for the determination of the permeability of flexible cellular polymeric materials to air flow.

It is applicable to test pieces cut from products of cellular material.

NOTE — ISO 7231, *Polymeric materials, cellular flexible — Method of assessment of air flow value at constant pressure drop*,¹⁾ specifies a simple quality control method which is also based on the flow of air through cellular materials. This can be used when it is not the intention to calculate the intrinsic properties of various materials in order to compare them, but merely to control the quality of a given cellular material.

2 References

ISO 471, *Rubber — Standard temperatures, humidities and times for the conditioning and testing of test pieces*.

ISO 845, *Cellular rubbers and plastics — Determination of apparent density*.

3 Principle

Passing air under controlled conditions through a test piece in the form of a cylinder or parallelepiped. Measurement of the pressure drop between the two free faces of the test piece.

4 Symbols and terminology

4.1 Air flow permeability, K , is given by Darcy's law (see figure 1), which describes the air flow in a homogeneous and isotropic (see note 1) porous medium under laminar flow conditions (see note 2) by the equation

$$u = \frac{q_V}{A} = \frac{K \Delta p}{\eta \delta}$$

where

- u is the linear air flow velocity, in metres per second;
- q_V is the volumetric air flow rate, in cubic metres per second, crossing the test piece;
- A is the right cross-sectional area, in square metres, of the test piece;
- K is the flow permeability, in square metres, of the porous medium;
- Δp is the pressure drop, in pascals, across the test piece;
- η is the dynamic viscosity, in pascal seconds, of air;
- δ is the thickness, in metres, of the test piece.

NOTES

- 1 For anisotropic materials, it is necessary to define the direction of the flow.
- 2 For the flow of air to be laminar in the interior of the porous medium, it is necessary for the following conditions to be fulfilled:

$$Re^* = \frac{u\sqrt{K}}{\nu} < n$$

where

- Re^* is the modified Reynolds number;
- ν is the kinematic viscosity, in square metres per second, of air;

1) At present at the stage of draft.