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Ageing of thermal insulation materials — Determination of the long-term change in thermal resistance of closed-cell plastics (accelerated laboratory test methods)

Vieillissement des matériaux isolants thermiques — Détermination du changement à long terme de la résistance thermique des plastiques alvéolaires à cellules fermées (méthodes d'essai de laboratoire accélérées)

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Contents

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

Draft International Standards adopted by technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75% of the member bodies casting a vote.

International Standard ISO 11561 was prepared by Technical Committee ISO/TC 163, *Thermal insulation*, Subcommittee SC 1, *Test and measurement methods*.

Annexes A and B of this International Standard are for information only.

Introduction

The purpose of this International Standard is to determine the ageing (long-term decrease in thermal resistance) of closed-cell cellular plastic materials and products which have properties that, due to diffusion of contained gases, change with time. The thermal resistance and its rate of change will vary with product variability, temperature and thickness, and also within the thickness due to cross-sectional variability and the effects of natural or applied surface skins or protective facings.

The long-term thermal resistance is one property required for establishing design thermal performance under service conditions and for determining life-time energy requirements.

This International Standard contains two procedures based on the conditioning of thin slices at room temperature, since conditioning at elevated temperatures can induce changes in a material other than those due to diffusion processes. The first, method A, relates to the core material only. An alternative, method B, is a simplified test to determine a conservative value of a design life-time thermal performance of a product. Two informative annexes provide essential background information on the ageing process and on the factors to be considered when measurements are required on faced products.

The phenomenon and mechanisms of ageing have been known and understood for many years. The use of a blowing agent produces a relatively uniform cell size and initial high thermal resistivity. However, during the subsequent life of the foam, the principle component gases in the air diffuse into the cells and this increases the cell gas pressure, effectively increasing the thermal conductivity of the gas mixtures. In addition, some of the blowing agent is absorbed by or dissolved into the polymer matrix, saturating it, while the remainder diffuses out. This inward diffusion is influenced by appropriate diffusion coefficients. These in turn are influenced by the temperature, effective cell diameter in the direction of movement of air components, and the nature of the polymer matrix.

Since the diffusion of nitrogen and oxygen molecules into the cells is very much faster than the outward diffusion of the generally used larger molecule (the blowing agent), the whole ageing process is a combination of two stages:

a) a primary stage (thermal drift) due to the significant rate of change of cell gas composition (usually complete within 5 years);

b) a secondary stage where air diffusion is complete but there is still very slow outward diffusion of the blowing agent (a period much greater than 10 years and estimated in some cases to be over 100 years).