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BSI Standards Publication

Rubber, unvulcanized — Determinations using a shearing-disc viscometer

Part 4: Determination of the Mooney stress-relaxation rate

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National foreword

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A list of organizations represented on this committee can be obtained on request to its secretary.

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Part 4: Determination of the Mooney stress-relaxation rate

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Foreword

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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 documents 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).

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For an explanation on 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 the following URL: www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 45, *Rubber and rubber products*, Subcommittee SC 2, *Testing and analysis*.

This first edition of ISO/TS 289-4 cancels and replaces ISO 289-4:2003, which has been technically revised.

The main changes are:

— publication as an ISO Technical Specification instead of an International Standard;

— the addition of Annex B.

A list of all parts in the ISO 289 series can be found on the ISO website.

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Introduction

Mooney viscosity, as defined in ISO 289-1, is one of the most widely accepted rubber characterization parameters. However, Mooney viscosity alone is usually insufficient to guarantee that other rheological properties are well controlled[2]. It does not give any information about the elasticity of raw and unvulcanized rubbers[3]. Viscosity and elasticity can change independently; therefore, it is important to have test procedures available that are able to measure both properties independently.

Mooney viscosity is measured at one specific shear rate and rubbers exhibit shear rate-dependant viscosity. Sophisticated test equipment to measure the viscosity of a rubber as a function of the shear rate is available. Generally speaking, this type of equipment, its operation and the interpretation of the results are too complicated to be used as a standard quality control tool at present.

As described in the literature[4], the Mooney stress-relaxation is related to the elastic effects in the rheology of unvulcanized rubbers. It can be measured relatively easily and only takes a few seconds extra at the end of a standard Mooney viscosity measurement. The Mooney stress-relaxation rate (MSR) parameter is independent from Mooney viscosity.

Mooney stress-relaxation, combined with the conventional Mooney viscosity, gives a better description of the visco-elastic behaviour of uncompounded as well as compounded, unvulcanized rubbers[5]. Mooney stress-relaxation measurements have been proposed as a quality control tool[6][7].

The short interval method as described in this document is a refinement of the evaluation procedures for Mooney stress-relaxation measurements. Short interval evaluation leads to higher reproducibility compared to using an extended interval.

Using a short interval, a major parameter relevant to rubber rheology can be obtained from Mooney stress-relaxation experiments *viz*. the Mooney stress-relaxation rate, i.e. the rate of decay of torque versus time[8][9][10][11].

The Mooney stress-relaxation rate also has been referred to as “slope”, where the latter is sometimes presented as a positive and sometimes as a negative value. As the method described in this document uses a specific evaluation interval and the parameter is always referred to as a positive value, a new distinctive name has been chosen[12][13][14][15].

Data are available to show that the described method distinguishes polymers (EPDM) with different high molecular weight fractions despite the short evaluation interval.

The decision to publish this document as a Technical Specification instead of an International Standard is based on the fact that the method in this document was new and not widely enough practised at the time of development.

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