AS 1683.22—2001
ISO 3417:1991

Australian Standard™

Methods of test for elastomers

Method 22: Determination of vulcanization characteristics using the oscillating disc curemeter

PREFACE

This Standard was prepared by the Standards Australia Committee RU-003, Analysis and Testing of Elastomers to supersede AS 1683.22—1983, *Methods of test for rubber,* Method 24: *Rubber—Determination of vulcanization characteristics using the oscillating disc curemeter.*

The objective of this Standard is to provide manufacturers and users of elastomeric materials with a method for determining selected vulcanization characteristics of a rubber compound by means of the oscillating disc curemeter.

This Standard is identical with and has been reproduced from ISO 3417:1991, *Rubber—Measurement of vulcanization characteristics with the oscillating disc curemeter.*

The term 'informative' has been used in this Standard to define the application of the annex to which it applies. An 'informative' annex is only for information and guidance.

As this Standard is reproduced from an international Standard, the following applies:

(a) Its number appears on the cover and title page while the International Standard number appears only on the cover.

(b) In the source text, 'this International Standard' should read 'this Australian Standard'.

(c) A full point substitutes for a comma when referring to a decimal marker.

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NOTES

1 Scope

This International Standard specifies a method for determining selected vulcanization characteristics of a rubber compound by means of the oscillating disc curemeter.

2 Principle

2.1 A test piece of rubber is contained in a sealed test cavity under an initial positive pressure and maintained at an elevated temperature. A biconical disc is embedded in the test piece and is oscillated through a small rotary amplitude. This action exerts a shear strain on the test piece and the force (torque) required to oscillate the disc depends on the stiffness (shear modulus) of the rubber. The torque is recorded autographically as a function of time.

Direct proportionality between torque and stiffness cannot be expected under all test conditions because — particularly in higher torque ranges — an elastic deformation of disc shaft and driving device must be taken into account. Moreover, in cases of small amplitudes of deformation, the strain can be expected to have a considerable elastic component. For routine control purposes, corrections are not necessary.

2.2 The stiffness of the rubber test piece increases as vulcanization proceeds. The curve is complete when the recorded torque rises either to an equilibrium value or to a maximum value (see figure 1). The time required to obtain a vulcanization curve is a function of the test temperature and the characteristics of the rubber compound.

2.3 The following measurements can be taken from the recorded curve of torque as a function of time, i.e. $M = f(t)$ (see figure 1).

M_L: minimum torque;

t_{sx}: time to incipient cure (scorch time);

$t_c(y)$: time to a percentage of full cure;

M_{HF}: plateau torque;

M_{HR}: maximum torque (reverting curve); or

M_H: highest torque value attained in a curve where no plateau or maximum value is obtained after the specified time.

The minimum torque M_L depends on the stiffness and the viscosity at low shear rate of the unvulcanized compound.

The time to incipient cure t_{sx} is a measure of processing safety. The time to optimum cure $t_c(y)$ is measured at some percentage y of the highest torque and the highest torque is a measure of the stiffness of the fully cured vulcanizate at the test temperature. The cure rate index (see 8.4) is the average slope of the rising cure curve.

3 Apparatus

3.1 Curemeter

The curemeter consists of a biconical disc in a temperature-controlled die cavity. The shaft of the disc is secured in a drive shaft and oscillated through a small rotary amplitude.

The torque applied to the disc represents the resistance of the rubber test piece to deformation and is recorded autographically to yield a curve of torque versus time. The die-disc relationship is shown in figure 2.

3.2 Die cavity

3.2.1 The dies shall be manufactured from a non-deforming tool steel having a minimum Rockwell hardness of 50 HRC.

The geometry of the dies is shown in figure 3 and