STANDARDS ASSOCIATION OF AUSTRALIA

Australian Standard METHODS OF TESTING BITUMEN AND RELATED ROADMAKING PRODUCTS

AS 2341.5

DETERMINATION OF APPARENT VISCOSITY BY 'SHELL' SLIDING PLATE MICRO-VISCOMETER

1 SCOPE. This standard sets out a procedure for the determination of apparent viscosity of bitumens at a specified shear strain rate by means of the 'Shell' sliding plate micro-viscometer.

2 REFERENCED DOCUMENTS. The following standards are referred to in this standard:

AS 1701 White Spirit

AS 2341 Methods of Testing Bitumen and Related Roadmaking Products.
- 2341.1 Precision Data—Definitions
- 2341.2 Determination of Dynamic Viscosity by Flow Through a Capillary Tube
- 2341.3 Determination of Kinematic Viscosity by Flow Through a Capillary Tube
- 2341.4 Determination of Dynamic Viscosity by Rotational Viscometer
- 2341.10 Determination of the Effect of Heat and Air on a Moving Film of Bitumen (Rolling Thin Film Oven (RTFO) Test)
- 2341.13 Determination of Durability of Bitumen

ASTM E1 Standard Specification for ASTM Thermometers

3 APPLICATION. The method is particularly applicable for the assessment of—

(a) increase in viscosity of a bitumen which has been hardened in accordance with AS 2341.13 by measuring the apparent viscosity at 45 °C and at a shear strain rate of $5 \times 10^{-3}\ s^{-1}$ after the treatment;

NOTE: If this method is used to determine the increase in viscosity produced by the RTFO treatment, the result will be of poor precision because of the small increase involved. For higher precision the increases should be determined in accordance with AS 2341.2 or AS 2341.3 or AS 2341.4.

(b) the condition of bitumen recovered from seals by measuring apparent viscosity at 45 °C and $5 \times 10^{-3}\ s^{-1}$;

(c) increase in viscosity of a bitumen which has been hardened in accordance with AS 2341.10 (RTFO treatment) by measuring the apparent viscosity at 25 °C and at a shear strain rate of $1 \times 10^{-2}\ s^{-1}$ before and after the treatment.

4 PRINCIPLE. A bitumen film of known thickness is sheared between a matched pair of parallel flat glass plates. One plate is clamped in a fixed position and the other is displaced in the direction of the plane of the film by a constant force. The displacement velocity of the moving plate is measured. Shear strain rate, shear stress, and apparent viscosity are calculated from the dimensions of the specimen, displacement velocity, and load. Measurements are taken at several different loads and the relationship between apparent viscosity and shear strain rate is determined.

5 APPARATUS. The following apparatus is required:

(a) *Sliding plate micro-viscometer* (Shell Development Co design and manufactured by Stanhope-Seta, Park Close, Englefield Green, Surrey, UK). Basic details of the viscometer are shown schematically in Fig. 1. The sample is contained between two plates. One plate is clamped in a fixed position in the frame and the other is held in a spring clamp at the end of the operating rod which has a contact plate attached to it. The operating rod and a weight holder are attached to opposite ends of a balance arm by knife edges which are equidistant from the pivot point.

When a load is applied to the weight holder, the resultant upward movement of the sample plate is followed by a resistance contact servo system. The servo motor rotates an insulated micrometer, which maintains a (high resistance) contact between its tip and the contact plate attached to the operating rod. The electrical circuit to ground is normally completed through the water in the water bath.

Coupled to the micrometer is a potentiometer which enables an electrical voltage proportional to the plate movement to be recorded as a function of time.

(b) *Chart recorder.* The chart recorder should have a full scale deflection of 100 mV and chart speeds in the range *1 cm/h to 60 cm/min*. The chart width should preferably be 200 mm or greater.

(c) *Viscometer plates.* Viscometer plates should be of polished plate glass, nominally 6 mm thick. The edges are ground together to accurate rectangular prisms, 20 ±0.1 mm × 30 ±0.1 mm so that all plates and faces of plates are interchangeable.