Test method T1203

Refractive index (R.I.) of glass beads

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Revision Summary

Ed/Rev Number	Clause Number	Description of Revision	Authorisation	Date
		Reformatted and Revision Summary Added	D.Dash	June 2001
Ed 2/ Rev 0	All	Reformatted RMS template	J Friedrich	November 2012

Note that Roads and Maritime Services is hereafter referred to as 'RMS'.

The most recent revision to Test method T1203 (other than minor editorial changes) are indicated by a vertical line in the margin as shown here.

Test method T1203

Refractive index (R.I.) of glass beads

1.   Scope

This test method sets out the procedure for determining the refractive index of glass beads by microscopic method making use of the 'Becke Line' effect when the beads are immersed in liquids of known refractive index. The test method has been developed from that outlined in the Australian Standard Specification E42-1967.

2.   Apparatus

(a)   Microscope with a magnification of 50 x or alternatively a shadowgraph with a similar magnification.

(b)   Microscopic slides of medium thickness (approximately 1.2 mm) having ground and polished circular concavities (approximately 1.8mm diameter).

(c)   Petri dish 50 mm diameter with cover glass.

(d)   Set of certified (R.I.) liquids of A.R. grade, appropriate liquids may be selected from the list of liquids supplied below.

3.   Procedure

3.1   Microscope Method

(a)   Place a small quantity of the beads to be tested (enough to cover an area of about 6 mm diameter with a single layer) in the concavity of a glass slide.

(b)   Select a liquid of known R.I. close to the suspected R.I. of the beads. Place a drop or two on the beads so as to cover them completely.

A glass cover slip may be used approximately to cover the beads and a drop of the R.I. liquid introduced beneath the edge of the slip. The capillary effect will cover the beads with oil and give a reasonably large test area.

(c)   Adjust the light (Natural or from a microscope illuminator) by means of the sub-stage mirror and iris diaphragm to give a low intensity illumination on the beads under examination.

(d)   Focus the microscope on the beads. Then slowly vary the focus first in one direction and then the other while closely observing the appearance of individual beads. In general a thin bright 'line' (the Becke line) parallel with the boundary of each bead will be seen. This line will move towards the centre of the bead or out form the boundary of the bead as the focus is varied in each direction.

(e)   Observe the movement of the Becke line, as the microscope tube is lowered with respect to the stage. One of the three following situations will be observed.

   (i)   The Becke line moves in towards the centre of the bead. The R.I. of the liquid is greater than that of the glass bead.

   (ii)   The Becke line moves out from the boundary of the bead. The R.I. of the liquid is lower than that of the glass bead.

   (iii)   The beads become almost invisible when the microscope is correctly focused and have a blurred outline when the focus is moved in either direction. In this case the R.I.'s of the beads and the liquid are the same.

(f)   Continue the selection of liquids until case (iii) above is found or the R.I. is determined to be between two close limits (e.g. between 1.51 and 1.52).

3.2 Shadowgraph Method

(a) Place a sample of 100 to 200 beads in a petri dish and add 2-4ml of a selected liquid with a know R.I. close to the suspected R.I. of the beads. Cover with a cover glass.

(b) Adjust the focus of the shadowgraph until the beads are just in focus and then slowly vary the focus first in one direction and then the other while closely observing the appearance of individual beads. In general a thin a bright 'line' (the Becke line) parallel to the boundary of each bead will be seen. This line will move in towards the centre of the bead or out form the boundary of the bead as the focus is varied in each direction.

(c) Observe the movement of the Becke line as the shadowgraph stage is raised. One of the three following situations will be observed:

    (i) The Becke line moves in towards the centre of the bead. The R.I. of the liquid is greater than that of the glass bead.

    (ii) The Becke line moves out from the boundary of the bead. The R.I. of the liquid is lower than that of the glass bead.

    (iii) The beads become almost invisible when the shadowgraph is correctly focused and have a blurred outline when the focus is moved in either direction. In this case the R.I.'s of the beads and the liquid are the same.

(d) Continue the selection of liquids until case (iii) above is found or the R.I. is determined to lie between two close limits (e.g. between 1.51 and 1.52).

4. Reporting

Report the R.I. of the beads as being within certain limits which will normally bw 0.01 apart e.g. R.I. of the beads is 1.51-1.52.

5. Precautions

1. Always use A.R. grade liquids.

2. Do not inhale vapours of the liquids as some are extremely toxic (e.g. Benzol etc.

Liquid standards for refractive index determinations by immersion methods.

INDEX OF REFRACTION AT 25ºC

1.47	Glycerine
1.49	Dibutyl phthalate
1.498	Toluene
1.498	o-Xylene
1.505	Anisol
1.52	Chlorbenzene

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