SLOVENSKI STANDARD
SIST EN 14210:2004

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Površinsko aktivne snovi - Določanje površinske napetosti raztopin površinsko aktivnih snovi z metodo zanke

Surface active agents - Determination of interfacial tension of solutions of surface active agents by the stirrup or ring method

Grenzflächenaktive Stoffe - Bestimmung der Grenzflächenspannung von grenzflächenaktiven Lösungen mittels Bügel- oder Ringverfahren

Agents de surface - Détermination de la tension interfaciale des solution d'agents de surface par la méthode a l'anneau ou l'étrier

Ta slovenski standard je istoveten z: **EN 14210:2003**

ICS:

71.100.40	Površinsko aktivna sredstva	Surface active agents

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English version

Surface active agents - Determination of interfacial tension of solutions of surface active agents by the stirrup or ring method

Agents de surface - Détermination de la tension interfaciale des solution d'agents de surface par la méthode à l'anneau ou l'étrier

Grenzflächenaktive Stoffe - Bestimmung der Grenzflächenspannung von grenzflächenaktiven Lösungen mittels Bügel- oder Ringverfahren

This European Standard was approved by CEN on 1 October 2003.

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CEN members are the national standards bodies of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Slovakia, Spain, Sweden, Switzerland and United Kingdom.

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Foreword

This document EN 14210:2003 has been prepared by Technical Committee CEN/TC 276 “Surface active agents”, the secretariat of which is held by AFNOR.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by June 2004, and conflicting national standards shall be withdrawn at the latest by June 2004.

This document includes a Bibliography.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard : Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Slovakia, Spain, Sweden, Switzerland and the United Kingdom.

1 Scope

This European Standard specifies test methods for the determination of interfacial tension in the range from 4 mN/m to 50 mN/m between two immiscible liquids which can also be free from surface active agents.

It is particularly suitable for determining the interfacial tension between water or aqueous solutions and organic liquids which are immiscible with water.

2 Principle

The maximum force, F, necessary to pull or to force a stirrup or ring of length, l, out of the interface between two liquids in the direction of the nonaqueous phase is measured. The interfacial tension, γ, is obtained by calculation where the following approximate equation (1) serves as base:

$$\gamma = \frac{F}{2l} \tag{1}$$

3 Apparatus

3.1 Tensiometer

3.1.1 General

The tensiometer shall be designed for use with a stirrup or ring and shall consist essentially of the parts specified in 3.1.2 and 3.1.3.

3.1.2 Dynamometer (e.g. torsion balance or inductive force transducer), capable for reading off the force to the nearest 0,1 mN/m over the effective length of the stirrup or ring.

3.1.3 Support for the measuring vessel, consisting of a horizontal platform which can be moved vertically up and down, e.g. with the aid of a precision drive.

3.2 Stirrup

The stirrup shall consist of platinum/iridium wire with a test wire diameter of 0,1 mm and a length of 20 mm to 40 mm. The length of the two branches shall be about 20 mm. Two small platinum balls can be attached to the lower ends of the branches as counterweights or, alternatively, the lower ends of the branches can be joined by a platinum wire (see Figure 1 as an example).

Dimensions in millimetres

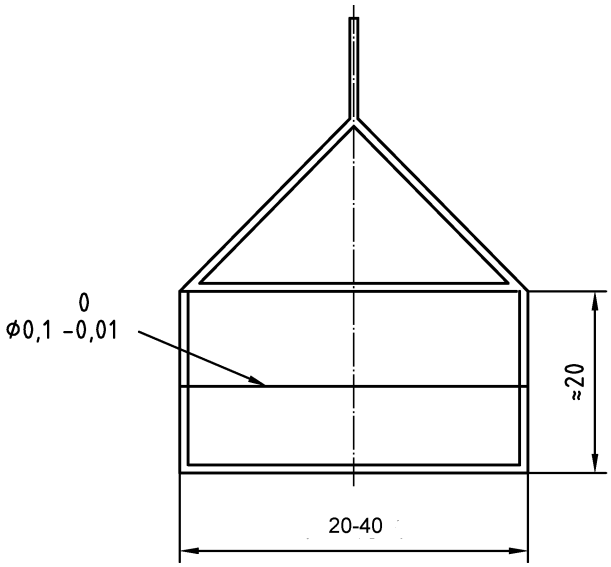


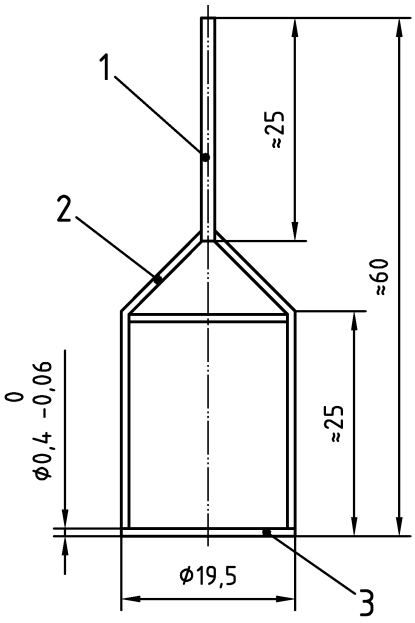
Figure 1 — Stirrup for measuring interfacial tension

NOTE The stirrup specified in EN 14370 for measuring the surface tension is identical with that one shown in Figure 1, except for the lengths of the measuring wire and the branches.

3.3 Ring

The ring shall consist of a platinum or platinum/iridium wire with a thickness less than or equal to 0,4 mm and a mean circumference of 60 mm. By means of a wire stirrup, it shall be attached in a horizontal position to a metal rod forming the link to the tensiometer (see Figure 2 as an example).

Dimensions in millimetres



Key

1 Metal rod
2 Wire loop
3 Ring

Figure 2 — Ring for measuring interfacial tension

NOTE The ring specified in EN 14370 for measuring the surface tension is identical with that one shown in Figure 2.

3.4 Sample vessel

The sample vessel for the liquid under test shall be a glass vessel which is suitable for use in a thermostat. It shall have a sufficient capacity for the liquid which, if necessary, shall be protected from evaporation. It shall be constructed such that the temperature of the gas phase above the liquid can also be kept constant by thermostat. There is no need to use a thermostat for measurement at room temperature. The sample vessel shall consist of a cylindrical glass container with an internal diameter of at least 45 mm for use with the ring method or stirrup method.

NOTE If a vessel of less than 45 mm diameter needs to be used (for example, if only small amounts of sample are available), wall effects can cause an error in the interfacial tension measurement. The magnitude of this error depends on the distance between the wall of the vessel and the edge of the ring or stirrup.

4 Preparation of apparatus

4.1 Cleaning

Clean the glass vessels carefully, first by thorough preliminary cleaning using a suitable solvent, for example propan-2-ol or propanone. Then rinse them repeatedly with freshly double distilled water and dry them. Clean and rinse the stirrups or rings in the same manner, and then heat them briefly to incandescence in a methanol or ethanol flame (the latter may be preferred since it has a low vapour pressure and higher flash point), preferably a non-luminous natural gas flame, ensuring they are only heated to red heat and never to white heat.

NOTE Should the stirrups or rings become contaminated with residues, for example from silicones or cationic surface active agents, it can be preferable to clean with a sulfo-chromic acid mixture or as specified in ISO 6889.

4.2 Measurement preparation

Double-distilled water or water of equivalent purity shall be used to prepare any aqueous solution required for the test.

The temperature of the liquids shall be kept constant to the nearest 0,5 °C during the measurement. The measurement temperature chosen shall be an appropriate one for the objective of a particular test. Measurements at room temperature present the fewest problems.

The interfacial tension changes with time and can be affected by the chemical nature of a surface active agent, its concentration, whether it is dissolved in the upper or lower phase, its adsorptive capacity and its adsorption rate during the change. So it is not possible to specify an appropriate time for starting the measurements. Therefore, several measurements of the interfacial tension as a function of time and, consequently, of the age of the interface shall be performed. After a time which is characteristic for every system, no further changes are observed in the interfacial tension since an equilibrium state is established. It is advantageous to use commercially available, automatic tensiometers to carry out such measurements.

Interfacial systems are extremely sensitive to contaminants. For this reason, no work involving volatile substances shall be carried out in the measurement room and the apparatus shall be protected by an enclosure of the type used for balances. This precaution also facilitates maintenance of a constant temperature.

5 Procedure

5.1 General

Two methods of measurement are described in 5.2 and 5.3. In the relative stirrup or ring method (see 5.2), the measured value is compared with the corresponding value determined on a system of two liquids with similar densities to those of the liquids under test densities and known interfacial tension. In the absolute ring method (5.3), account is taken of a factor for the apparatus determined using an adjustment weight and a Zuidema and Waters correction factor [1] when determining the interfacial tension. The Zuidema and Waters factor is based on the correction determined empirically by Harkins and Jordan [2] for measurements made by the ring method. Different measurement procedures are adopted, depending on whether the density of the aqueous phase is greater or less than that of the nonaqueous phase.

5.2 Relative stirrup or ring method

5.2.1 Method A

Method A is a method for systems in which the density of the aqueous phase is greater than that of the nonaqueous phase.

Use a pipette to transfer an amount of the aqueous phase about 15 mm deep to the measuring apparatus holding the tip of the pipette against the vessel wall, avoiding bubbles. Check that the test wire of the stirrup or ring is horizontal by using the surface of the liquid as a mirror when the stirrup or ring is just above it. Then slowly raise the platform and the measurement vessel until the stirrup test wire or ring is immersed in the aqueous phase. Then