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## Plastics — Film and sheeting — Determination of wetting tension

*Plastiques — Film et feuille — Détermination de la tension de mouillage*

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Reference number  
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## Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council. They are approved in accordance with ISO procedures requiring at least 75 % approval by the member bodies voting.

International Standard ISO 8296 was prepared by Technical Committee ISO/TC 61, *Plastics*.

Users should note that all International Standards undergo revision from time to time and that any reference made herein to any other International Standard implies its latest edition, unless otherwise stated.

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# Plastics — Film and sheeting — Determination of wetting tension

## 1 Scope and field of application

**1.1** This International Standard specifies a method for determining the wetting tension of surfaces of plastic film and sheeting in contact with drops of specific test solutions.

**1.2** The ability of plastic films to retain inks, coatings, adhesives, etc., is primarily dependent on the character of their surfaces, and can be improved by one of several surface-treating techniques. These same treating techniques have been found to increase the wetting tension of a plastic film surface in contact with mixtures of solvents. It is therefore possible to relate the wetting tension of a plastic film surface to its ability to accept and retain inks, coatings, adhesives, etc. The measured wetting tension of a specific film surface can only be related to acceptable ink, coating, or adhesive retention through experience. Wetting tension, in itself, is not a completely acceptable measure of ink, coating or adhesive adhesion.

**1.3** Any contamination of the film surface and any trace of surface-active impurities in the liquid reagents may affect the wetting tension. It is therefore important that the portion of the film surface to be tested is not touched or rubbed, that all equipment be scrupulously clean, and that reagent purity be carefully controlled. Glass apparatus, in particular, is likely to be contaminated with detergents having very strong surface tension reducing ability, unless specific precautions are taken to ensure their absence such as by cleaning with an oxidizing agent, for example chromic-sulfuric acid or sulfuric acid-ammonium peroxydisulfate, and rinsing with distilled water.

**1.4** The test is not applicable when the surface of the material to be tested reacts chemically with the test solution.

**1.5** It should be noted that surface properties of plastic film and sheeting may change by ageing processes. The measurements must therefore be related to the age of the film.

## 2 Reference

ISO 291, *Plastics — Standard atmospheres for conditioning and testing*.

## 3 Principle

A series of mixtures of solvents of gradually increasing surface tension are applied to the surface of the plastic film until a

mixture is obtained that just wets the film surface. The wetting tension of the surface under test is approximated by the surface tension of this particular mixture.

## 4 Apparatus

Ordinary laboratory apparatus and

**4.1 Hand-coater**, with wire bar No. 2 depositing a 12  $\mu\text{m}$  film. Alternatively, cotton-tipped wood sticks or brushes may be used, provided that they give the same test result.

**4.2 Brown-glass dropper bottles.**

## 5 Test mixtures

Test mixtures of graduated wetting tension shall be prepared by mixing reagent grades of ethylene glycol monoethyl ether (Cellosolve), formamide, methanol and water according to the table. The test mixtures shall be stored in the brown-glass dropper bottles (4.2). If well protected, the mixtures change very little with time. If used frequently, they shall be renewed after 3 months.

**Safety precautions — When handling the solvents, the appropriate laboratory safety precautions must be taken.**

## 6 Sampling

Whether a film is presented in the form of rolls or in the form of piled sheets, two surfaces are in contact (as a rule, front with reverse). When sampling, care must be taken that the surfaces to be tested do not come into contact with any other material. In the case of a roll, this is achieved by discarding the outer layer and unwinding a sample without touching the areas to be tested. In the case of a pile, some sheets are taken together and the outermost sheets discarded before testing.

The actual specimens for testing shall be taken from these samples immediately before the tests are carried out. Normally, a specimen 10 cm  $\times$  10 cm is sufficient.

## 7 Procedure

**7.1** Conduct the test in the standard laboratory atmosphere 23/50 (see ISO 291).

**7.2** Place the test specimen on the ground plate of the hand-coater (4.1). Apply a few drops of the test mixture (clause 5) to the film in front of the wire bar and spread immediately by drawing the bar.

If a brush or cotton-tipped stick is used for spreading the test mixtures, the liquid shall be spread rapidly over an area of at least 20 cm<sup>2</sup>. The quantity of liquid shall be such that it forms a thin film without pools.

Observe the liquid film of the test mixture under glancing illumination and note the time taken for the continuous liquid film to break up into droplets. If the liquid film holds together for more than 2 s, repeat the test on a new specimen with a mixture of the next higher surface tension, until the liquid film breaks up in less than 2 s. If the liquid film holds for less than 2 s, proceed to lower surface tensions until the film persists for 2 s.

**7.3** For each test, use a new cotton applicator. Clean the brush or wire bar after each use by rinsing in methanol and dry-

ing, because the liquid remaining on these spreaders will change in composition and surface tension by evaporation.

**7.4** Note the mixture that comes nearest to wetting the surface for 2 s, based on at least three determinations with that mixture. The surface tension of this mixture shall be reported as the wetting tension of the plastic film.

## 8 Test report

The test report shall include the following particulars :

- a) reference to this International Standard;
- b) identification of the plastic film and, if known, its approximate age;
- c) side and location tested;
- d) the wetting tension of the film.

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Table – Test mixtures for the determination of the wetting tension of plastic film and sheeting

Wetting tension	Ethylene glycol monoethyl ether	Formamide	Methanol	Water
mN/m	ml	ml	ml	ml
22,6			100,0	0
25,4			90,0	10,0
27,3			80,0	20,0
30,0	100,0			
31,0	97,5	2,5		
32,0	89,5	10,5		
33,0	81,0	19,0		
34,0	73,5	26,5		
35,0	65,0	35,0		
36,0	57,5	42,5		
37,0	51,5	48,5		
38,0	46,0	54,0		
39,0	41,0	59,0		
40,0	36,5	63,5		
41,0	32,5	67,5		
42,0	28,5	71,5		
43,0	25,3	74,7		
44,0	22,0	78,0		
45,0	19,7	80,3		
46,0	17,0	83,0		
48,0	13,0	87,0		
50,0	9,3	90,7		
52,0	6,3	93,7		
54,0	3,5	96,5		
56,0	1,0	99,0		
58,0		100,0		
59,0		95,0		5,0
60,0		80,0		20,0
61,0		70,0		30,0
62,0		64,0		36,0
63,0		50,0		50,0
64,0		46,0		54,0
65,0		30,0		70,0
67,0		20,0		80,0
70,0		10,0		90,0
73,0				100,0

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