



Designation: D7490 – 13 (Reapproved 2022)

Standard Test Method for Measurement of the Surface Tension of Solid Coatings, Substrates and Pigments using Contact Angle Measurements¹

This standard is issued under the fixed designation D7490; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This test method describes a procedure for the measurement of contact angles of two liquids, one polar and the other nonpolar, of known surface tension on a substrate, pigment (in the form of a disk), or cured or air dried coating in order to calculate the surface properties (surface tension and its dispersion and polar components) of the solid.

1.2 The total solid surface tension range that can be determined using this method is approximately 20 to 60 dyn/cm.

1.3 The values stated in CGS units (dyn/cm) are to be regarded as standard. No other units of measurement are included in this standard.

1.4 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.5 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*²

D1193 Specification for Reagent Water

D5725 Test Method for Surface Wettability and Absorbency of Sheeted Materials Using an Automated Contact Angle

¹ This test method is under the jurisdiction of ASTM Committee D01 on Paint and Related Coatings, Materials, and Applications and is the direct responsibility of Subcommittee D01.23 on Physical Properties of Applied Paint Films.

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² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

Tester (Withdrawn 2010)³

D7334 Practice for Surface Wettability of Coatings, Substrates and Pigments by Advancing Contact Angle Measurement

3. Terminology

3.1 *Definitions:*

3.1.1 *contact angle, n* —the interior angle that a drop makes between the substrate and a tangent drawn at the intersection between the drop and the substrate as shown in Fig. 1; this is the angle formed by a liquid at the three phase boundary where a liquid, gas (air) and solid intersect.

3.1.2 *dispersion component, n* —the component of solid surface tension that is related to intermolecular attraction caused by nonpolar dispersion forces.

3.1.3 *polar component, n* —the component of solid surface tension that is related to polar forces, such as hydrogen bonding and ion-dipole forces.

3.1.4 *solid surface tension, n* —the surface tension of a solid surface; this parameter cannot be measured directly, but must be determined by extrapolation of polymer melt or solution data to 100 % solids or by contact angles with liquids of known surface tension.

3.1.5 *surface energy, n* —excess free energy of surface molecules compared to those of the bulk material; arises from unbalanced molecular cohesive forces at a surface that cause the surface to contract and behave like a film or membrane (units are energy/unit areas such as joules/cm²).

3.1.6 *surface tension, n* —the force necessary to break the surface of a film of a given length (units are force/length, such as dyn/cm or newtons/m); the same numerically as surface energy, but different units.

4. Summary of Test Method

4.1 Contact angles of drops of distilled water and diiodomethane (methylene iodide) are measured on the surface of interest. The two values are then substituted into two

³ The last approved version of this historical standard is referenced on www.astm.org.