



Standard Test Method for Dynamic Surface Tension by the Fast-Bubble Technique¹

This standard is issued under the fixed designation D3825; 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 covers the determination of the specific free energy of a liquid-gas surface a short time after formation of the surface.

1.2 It is applicable to liquids with vapor pressures up to 30.0 kPa (225 torr) and kinematic viscosities up to 4.0 mm/s (4.0 cSt) at the test temperature. Higher viscosities have not yet been investigated.²

1.3 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only.

1.4 **Warning**—Mercury has been designated by EPA and many state agencies as a hazardous material that can cause central nervous system, kidney, and liver damage. Mercury, or its vapor, may be hazardous to health and corrosive to materials. Caution should be taken when handling mercury and mercury-containing products. See the applicable product Material Safety Data Sheet (MSDS) for details and EPA's website (<http://www.epa.gov/mercury/faq.htm>) for additional information. Users should be aware that selling mercury or mercury-containing products, or both, in your state may be prohibited by state law.

1.5 *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 consult and establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.* For specific warning statements, see 7.3, 7.4, and 7.5.

¹ This test method is under the jurisdiction of ASTM Committee D02 on Petroleum Products and Lubricants and is the direct responsibility of Subcommittee D02.L0.07 on Engineering Sciences of High Performance Fluids and Solids (Formerly D02.1100).

Current edition approved Dec. 1, 2009. Published December 2009. Originally approved in 1990. Last previous edition approved in 2005 as D3825–90(2005). DOI: 10.1520/D3825-09.

² Kloubek, J., "Measurement of the Dynamic Surface Tension by the Maximum Bubble Pressure Method, III," *Journal of Colloid and Interface Science*, Vol. 41, October 1972, pp. 7–16.

2. Referenced Documents

2.1 ASTM Standards:³

D1193 Specification for Reagent Water

D1331 Test Methods for Surface and Interfacial Tension of Solutions of Surface-Active Agents

E1 Specification for ASTM Liquid-in-Glass Thermometers

3. Terminology

3.1 Definitions:

3.1.1 *surface tension* (γ)—the specific surface free energy of a liquid gas interface, millinewton per metre (ergs/cm²).

3.2 Definitions of Terms Specific to This Standard:

3.2.1 *bubble frequency* (S)—bubbling rate, s^{−1}.

3.2.2 *bubble pressure* (ΔP)—difference between maximum pressures for the wide capillary (P_1) and the narrow capillary (P_2), Pa.

3.2.3 *dead time* (t_o)—time required from start to completion of a bubble, ms.

3.2.4 *dead time %*—fraction of a cycle ($t + t_o$) in the dead state, %.

3.2.5 *surface age* (t)—time required to start a new bubble, ms.

3.3 Symbols:

γ = surface tension, millinewtons per metre (dynes/cm)

S = bubble frequency, s^{−1}

t_o = dead time, ms

t = surface age, ms

D = density, kg/m³

r = radius, mm

ΔP = difference between maximum pressures, Pa

P_1 = maximum pressure for the wide capillary, Pa

P_2 = maximum pressure for the narrow capillary, Pa

³ 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.