



Designation: G40 – 21a

Standard Terminology Relating to Wear and Erosion¹

This standard is issued under the fixed designation G40; 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 The terms and their definitions given herein represent terminology relating to wear and erosion of solid bodies due to mechanical interactions such as occur with cavitation, impingement by liquid jets or drops or by solid particles, or relative motion against contacting solid surfaces or fluids. This scope interfaces with but generally excludes those processes where material loss is wholly or principally due to chemical action and other related technical fields as, for instance, lubrication.

1.2 This terminology is not exhaustive; the absence of any particular term from this collection does not necessarily imply that its use within this scope is discouraged. However, the terms given herein are the recommended terms for the concepts they represent unless otherwise noted.

1.3 Certain general terms and definitions may be restricted and interpreted, if necessary, to make them particularly applicable to the scope as defined herein.

1.4 The purpose of this terminology is to encourage uniformity and accuracy in the description of test methods and devices and in the reporting of test results in relation to wear and erosion.

NOTE 1—All terms are listed alphabetically. When a subsidiary term is defined in conjunction with the definition of a more generic term, an alphabetically-listed cross-reference is provided.

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.*

¹ This terminology is under the jurisdiction of ASTM Committee G02 on Wear and Erosion and is the direct responsibility of Subcommittee G02.91 on Terminology.

Current edition approved Nov. 1, 2021. Published November 2021. Originally approved in 1973. Last previous edition approved in 2021 as G40 – 21. DOI: 10.1520/G0040-21A.

2. Referenced Documents

2.1 ASTM Standards:²

C242 Terminology of Ceramic Whitewares and Related Products

D4175 Terminology Relating to Petroleum Products, Liquid Fuels, and Lubricants

3. Terminology

abradant, *n*—a material that is producing, or has produced, abrasive wear.

abrasion, *n*—in tribology, the process by which relative motion between a surface and hard particles or protuberances on an opposing surface produces abrasive wear of that surface. (See also **abrasive wear**.)

abrasive wear, *n*—wear due to hard particles or hard protuberances forced against and moving along a solid surface.

abrasion-corrosion, *n*—a synergistic process involving both abrasive wear and corrosion in which each of these processes is affected by the simultaneous action of the other and, in many cases, is thereby accelerated.

abrasivity, *n*—the ability of a material or substance to cause abrasive wear.

absolute impact velocity—See **impact velocity**.

acceleration period, *n*—in cavitation and liquid impingement erosion, the stage following the incubation period during which the erosion rate increases from near zero to a maximum value. (See also **erosion rate-time pattern**.)

accumulation period, *n*—in cavitation and liquid impingement erosion, a less-preferred term for **acceleration period**.

adhesive wear, *n*—wear due to localized bonding between contacting solid surfaces leading to material transfer between the two surfaces or loss from either surface.

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.

angle of attack, *n*—*in impingement erosion*, the angle between the direction of motion of an impinging liquid or solid particle and the tangent to the surface at the point of impact.

angle of incidence, *n*—*in impingement erosion*, the angle between the direction of motion of an impinging liquid or solid particle and the normal to the surface at the point of impact.

apparent area of contact, *n*—*in tribology*, the area of contact between two solid surfaces defined by the boundaries of their macroscopic interface. (Contrast with **real area of contact**.)

asperity, *n*—*in tribology*, a protuberance in the small-scale topographical irregularities of a solid surface.

attenuation period, *n*—*in cavitation and liquid impingement erosion*, a less-preferred term for **deceleration period**.

average erosion rate, *n*—a less preferred term for **cumulative erosion rate**. (See also **interval erosion rate**.)

Beilby layer, *n*—an altered surface layer of supposedly amorphous material formed on a crystalline solid during mechanical polishing, whose existence was proposed in Sir George Beilby's writings. The existence of such a layer is not supported by recent research, and the use of this term is therefore considered archaic and is strongly discouraged.

bio-tribocorrosion, *n*—in the field of medical devices and dental restoratives, a form of tribocorrosion in which biological substances make up one or more of the triboelements or are present in the contact region between them.

break-in, *n*—See **run-in**.

break in, *v*—See **run in**.

brinelling, *n*—damage to a solid bearing surface characterized by one or more plastically formed indentations caused by static or impulsive overloads, especially as found in rolling contact bearings. (See also **false brinelling**.)

brittle erosion behavior, *n*—erosion behavior having characteristic properties that can be associated with brittle fracture of the exposed surface; that is, little or no plastic flow occurs, but cracks form that eventually intersect to create erosion fragments. (See also **ductile erosion behavior**.)

DISCUSSION—In solid impingement an easily observable aspect of erosion helps to distinguish brittle from ductile behavior. This is the manner in which volume removal varies with the angle of attack. With brittle erosion the maximum volume removal occurs at an angle near 90°, in contrast to approximately 25° for ductile erosion behavior.

carrier fluid, *n*—*in impingement or slurry erosion*, fluid medium that transports impinging solid or liquid particles and that gives the particles their momentum relative to the solid surface on which they are impinging.

catastrophic period, *n*—*in cavitation or liquid impingement erosion*, a stage during which the erosion rate increases so drastically that continued exposure threatens or causes gross disintegration of the exposed surface. This stage is not inevitable; it is observed most commonly with some brittle materials. When it does occur, it may begin during any stage of the more common erosion rate-time pattern.

catastrophic wear, *n*—rapidly occurring or accelerating surface damage, deterioration, or change of shape caused by wear to such a degree that the service life of a part is appreciably shortened or its function is destroyed.

cavitating disk device (or apparatus), *n*—a flow cavitation test device in which cavitating wakes are produced by holes in, or protuberances on, a disk rotating within a liquid-filled chamber. Erosion test specimens are attached flush with the surface of the disk, at the location where the bubbles are presumed to collapse.

cavitating jet, *n*—a continuous liquid jet (sometimes submerged) in which cavitation is induced by the nozzle design, or sometimes by an obstruction placed in the center of the flow passage.

cavitating wake, *n*—See **flow cavitation**.

cavitation, *n*—the formation and subsequent collapse, within a liquid, of cavities or bubbles that contain vapor or a mixture of vapor and gas.

DISCUSSION—Cavitation originates from a local decrease in hydrostatic pressure in the liquid, usually produced by motion of the liquid (see **flow cavitation**) or of a solid boundary (see **vibratory cavitation**). It is distinguished in this way from boiling, which originates from an increase in liquid temperature.

DISCUSSION—The term cavitation, by itself, should *not* be used to denote the damage or erosion of a solid surface that can be caused by it; this effect of cavitation is termed **cavitation damage** or **cavitation erosion**. To erode a solid surface, bubbles or cavities must collapse on or near that surface.

cavitation cloud, *n*—a collection of a large number of cavitation bubbles. The bubbles in a cloud are small, typically less than 1 mm (0.04 in.) in cross section. A surface that is being eroded by cavitation is usually obscured by a cavitation cloud.

cavitation damage, *n*—See **damage**.

cavitation erosion, *n*—progressive loss of original material from a solid surface due to continued exposure to cavitation.

cavitation erosion test, *n*—a procedure whereby the surface of a solid is subjected to cavitation attack under specified, or measurable, or at least repeatable conditions.

DISCUSSION—Such tests can be divided into two major classes depending on whether flow cavitation or vibratory cavitation is generated.

cavitation number, σ , *n*—a dimensionless number that measures the tendency for cavitation to occur in a flowing stream of liquid, and that is computed from the equation:

$$\sigma = (P_o - P_v) / \frac{1}{2} \rho V_o^2 \quad (1)$$

where:

P_v = vapor pressure,

P_o = static pressure in the stream in an undisturbed state,

V_o = undisturbed stream velocity, and

ρ = liquid density.

DISCUSSION—The cavitation number and the net positive suction head (NPSH) are related by the equation: