



## Designation: ~~D3878 – 07 (Reapproved 2013)~~ **D3878 – 15**

# Standard Terminology for Composite Materials<sup>1</sup>

This standard is issued under the fixed designation D3878; 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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

*This standard has been approved for use by agencies of the U.S. Department of Defense.*

## 1. Scope

1.1 These definitions cover generic terms, including terms of commercial importance, that appear in one or more standards on composites containing high-modulus (greater than 20-GPa ( $3 \times 10^6$  psi)) fibers.

1.2 The definitions cover, in most cases, special meanings used in the composites industry. No attempt has been made to include common meanings of the same terms as used outside the composites industry.

1.3 Definitions included have, in general, been approved as standard.

## 2. Referenced Documents

2.1 *ASTM Standards:*<sup>2</sup>

[D123 Terminology Relating to Textiles](#)

2.2 *Military Industry Standard:*<sup>3</sup>

[MIL-HDBK-17/CMH-17 Composite Materials Handbook](#)

## 3. Terminology

3.1 *Definitions:*

$\pm 45^\circ$  **laminat**e—a balanced symmetric laminate composed of only  $+45^\circ$  plies and  $-45^\circ$  plies.

**angleply laminat**e—any balanced laminate consisting of plus and minus theta plies where theta is an acute angle with respect to a reference direction.

**balanced laminat**e—any laminate that contains one ply of minus theta orientation with respect to the laminate principal axis for every identical ply with a plus theta orientation.

**bond, n**—the act of adhering one surface to another, with or without the use of an adhesive at the interface.

*secondary bond, n*—the act of bonding two or more already-cured composite or other solid materials, during which the only chemical or thermal reaction, or both, occurring is the curing of the adhesive itself.

<sup>1</sup> This terminology is under the jurisdiction of ASTM Committee D30 on Composite Materials and is the direct responsibility of Subcommittee D30.01 on Editorial and Resource Standards.

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<sup>2</sup> 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.

<sup>3</sup> Available from ASTM/SAE International as (SAE), The Composite Materials Handbook—MIL-17-400 Commonwealth Dr., Warrendale, Also available as MIL-HDBK-17 from Standardization Documents Order Desk, DODSSP, Bldg. 4, Section D, 700 Robbins Ave., Philadelphia, PA 19111-5094 PA 15096, <http://www.sae.org>.

### DISCUSSION—

For example, a previously cured composite or metal doubler bonded via an adhesive to a previously cured skin, or a previously cured face sheet bonded via an adhesive to a honeycomb core. Also applies to bonding metallic substrates such as aluminum face sheets onto aluminum honeycomb core.

**braided fabric**—see *braided fabric* under **fabric**.

**breather string, n**—a string, composed of a material such as glass, that provides a vacuum path from the laminate to a breather.

**bundle**—a general term for a collection of essentially parallel filaments.

**carbon fiber precursor**—a material from which carbon fiber is made by pyrolysis. Polyacrylonitrile, rayon, or pitch fibers are commonly used precursors.

**catenary:**

*filament catenary*—the difference in length of the filaments in a specified length of tow, end, or strand as a result of unequal tension; the tendency of some filaments in a taut horizontal tow, end, or strand to sag lower than others.

*roving catenary*—the difference in length of the ends, tows, or strands in a specified length of roving as a result of unequal tension; the tendency of some ends, tows, or strands in a taut horizontal roving to sag lower than others.

**caul**, *n*—a flat or contoured tool used to distribute pressure and to define a surface for the top of the laminate during laminate consolidation or cure.

**co-bond**, *n*—(*cobond*) the act of bonding one semi-solid media (e.g. uncured thermoset polymer or a thermoplastic polymer) to a solid in a single process through principal action of the matrix possibly with the inclusion of a separate layer of adhesive.

**co-cure**, *n*—(*cocure*) the act of curing two semi-solid media (i.e. uncured thermoset polymers) in a single process resulting in the two media being bonded through principal action of the matrix, possibly with the inclusion of a separate layer of adhesive at the interface.

**co-fabrication**, *n*—(*in sandwich constructions, cofabrication*) a fabrication process where items such as inserts and other structural details are bonded into the panel—a composite structural component at the same time that the facings are bonded to the core; component is cured or consolidated.

**composite:**

*composite material*—a substance consisting of two or more materials, insoluble in one another, which are combined to form a useful engineering material possessing certain properties not possessed by the constituents.

DISCUSSION—

a composite material is inherently inhomogeneous on a microscopic scale but can often be assumed to be homogeneous on a macroscopic scale for certain engineering applications. The constituents of a composite retain their identities: they do not dissolve or otherwise merge completely into each other, although they act in concert.

*discontinuous fiber-reinforced composite*—any composite material consisting of a matrix reinforced by discontinuous fibers. The fibers may be whiskers or chopped fibers.

*fabric-reinforced composite*—any composite material consisting of a matrix reinforced by fabric (woven, knitted, or braided assemblages of fibers).

*fiber-reinforced composite*—any composite material consisting of a matrix reinforced by continuous or discontinuous fibers.

*filamentary composite*—a composite material reinforced with continuous fibers.

*unidirectional fiber-reinforced composite*—any fiber-reinforced composite with all fibers aligned in a single direction.

**continuous filament yarn**, *n*—two or more continuous filaments twisted into a single fiber bundle.

**core**, *n*—an inner layer of a multi-layer adherend assembly.

DISCUSSION—

The core is usually of a relatively low density material. It separates the surface layers, and other possible layers, of a multi-layer construction, generally stabilizing and transmitting shear between them.

*honeycomb core*, *n*—a core material having a thin-walled cell structure (often hexagonal) formed from a sheet material and resembling natural honeycomb in appearance.

DISCUSSION—

Honeycomb core materials exhibit anisotropic behavior; therefore the following notation is used:

*L* = ribbon or longitudinal direction of core, parallel to the material used to construct the core;

*W* = expanded or transverse direction of core; and

*T* = core thickness or cell depth.

**core shear instability**, *n*—the buckling of the core due to transverse shear stresses.

DISCUSSION—