Designation: B 713 – 82 (Reapproved 1997)ε1

AMERICAN SOCIETY FOR TESTING AND MATERIALS
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Standard Terminology Relating to Superconductors[1]

This standard is issued under the fixed designation B 713; 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.

ε[1] NOTE—Editorial changes were made throughout in March 1997.
Note—The designation after the definition indicates that the definition is either taken directly from the *Compilation of ASTM Standard Definitions*, and cites the standard in which it is used (for example, D2864) and the committee with jurisdiction (for example, D-27), or if new, it is designated B713, B-1.

1. Referenced Documents

1.1 *ASTM Standards:*

A 340 Terminology of Symbols and Definitions Relating to Magnetic Testing[2]
B 354 Terminology Relating to Uninsulated Metallic Electrical Conductors[3]
B 374 Terminology Relating to Electroplating[4]
D 123 Terminology Relating to Textiles[5]
D 1356 Terminology Relating to Sampling and Analysis of Atmospheres[6]
D 2864 Terminology Relating to Electrical Insulating Liquids and Gases[7]
E 7 Terminology Relating to Metallography[8]
E 41 Terminology Relating to Conditioning[9]
E 269 Definitions of Terms Relating to Magnetic Particle Inspection[10]
F 17 Terminology Relating to Flexible Barrier Materials[11]
F 303 Practices for Sampling Aerospace Fluids from Components[12]

2. Terminology

aspect ratio—ratio of the longer to the shorter transverse dimensions of a rectangular composite superconductor. **B 713, B-1**

barrier—any material limiting passage through itself of solids, liquids, semisolids, gases, or forms of energy such as ultraviolet light. **F 17, F-2**

braid, *n*—a narrow tubular or flat fabric produced by intertwining strands of materials according to a definite pattern. **D 123, D-13**

cable (concentric lay conductor)—conductor constructed with a central core surrounded by one or more layers of helically laid wires.

DISCUSSION—Several types of cables (concentric lay conductors) are compact round, conventional concentric, equilay, parallel core, rope-lay, unidirectional, and unilay, as follows:

conductor, compact round—a conductor constructed with a central core surrounded by one or more layers of helically laid wires and formed into final shape by rolling, drawing, or other means.

conductor, conventional concentric—conductor constructed with a round central core surrounded by one or more layers of helically laid round wires. The direction of lay is reversed in successive layers, and generally with an increase in length of lay for successive layers.

conductor, equilay—conductor constructed with a central core surrounded by more than one layer of helically laid wires, all layers having a common length of lay, direction of lay being reversed in successive layers.

conductor, parallel core—conductor constructed with a central core of parallel-laid wires surrounded by one layer of helically laid wires.

conductor, rope-lay—conductor constructed of a bunch-stranded or a concentric-stranded member or members, as a central core, around which are laid one or more helical layers of such members.

conductor, unidirectional—conductor constructed with a central core surrounded by more than one layer of helically laid wires, all layers having a common direction of lay, with increase in length of lay for each successive layer.

conductor, unilay—conductor constructed with a central core surrounded by more than one layer of helically laid wires, all layers having a common length and direction of lay. **B 354, B-1**

component—an individual piece or a complete assembly of individual pieces. **F 303, F-7**

composite conductor—a conductor consisting of two or more types of material, each type of material being plain, clad, or

[1] This terminology is under the jurisdiction of ASTM Committee B-1 on Electrical Conductors and is the direct responsibility of Subcommittee B01.08 on Superconductors.
Current edition approved Dec. 31, 1982. Published February 1983.
[2] *A nnual Book of ASTM Standards*, Vol 03.04.
[3] *Annual Book of ASTM Standards*, Vol 02.03.
[4] *Annual Book of ASTM Standards*, Vol 02.05.
[5] *Annual Book of ASTM Standards*, Vol 07.01.
[6] *Annual Book of ASTM Standards*, Vol 11.03.
[7] *Annual Book of ASTM Standards*, Vol 10.03.
[8] *Annual Book of ASTM Standards*, Vol 03.01.
[9] *Annual Book of ASTM Standards*, Vol 14.02.
[10] Discontinued; see *1990 Annual Book of ASTM Standards*, Vol 03.03.
[11] *Annual Book of ASTM Standards*, Vol 15.09.
[12] *Annual Book of ASTM Standards*, Vol 15.03.

coated, and assembled together to operate mechanically and electrically as a single conductor. **B 713, B-1**

composite superconductor—a conductor incorporating superconductive material.

DISCUSSION—Some types of composite superconductors are composite conductor, coreless, tape, tubular, and hollow, as follows:

conductor, composite—see **composite conductor.**

conductor, coreless—a conductor constructed of one or more layers of helically laid wires and formed into final shape by rolling, drawing, or other means.

conductor, tape—a conductor constructed in the form of a flat ribbon or strip.

conductor, tubular—a conductor constructed in the form of a tube.

conductor, hollow (also tubular conductor)—a conductor in which the individual elements are disposed about one or more hollow passages, the direction of which is along the axial length of the conductor. **B 713, B-1**

composition—the quantity of each of the components of a mixture; usually expressed in terms of the weight percentage, or the atomic percentage of each of the components in the mixture. **E 7, E-4**

conductivity, electrical—the ratio of the current density carried through a specimen to the potential gradient paralleling the current. This is numerically equal to the conductance between opposite faces of a unit cube of material. It is the reciprocal of resistivity. **D 2864, D-27**

conductor—a wire or combination of wires not insulated from one another, suitable for carrying an electrical current. **B 354, B-1**

critical current, I_c—the maximum electrical current below which a superconductor exhibits superconductivity at some given temperature and magnetic field. **B 713, B-1**

critical current density, J_c—the critical current divided by the total cross-sectional area of the conductor. **B 713, B-1**

critical magnetic field strength, H_{c2}—the maximum magnetic field below which a superconductor exhibits superconductivity at zero current and temperature. **B 713, B-1**

critical temperature, T_c—the maximum temperature below which a superconductor exhibits superconductivity at zero magnetic field and current. **B 713, B-1**

critical transition temperature—see **transition temperature.**

current, constant, I_{dc}—the steady current which is located in a winding and which produces a magnetostatic condition. **A 340, A-6**

current density (cd)—current per unit area. **B 374, B-8**

diamagnetic material—a material whose relative permeability is less than unity.

NOTE 1—The intrinsic induction, B_i, is oppositely directed to the applied magnetizing force H. **A 340, A-6**

filamentary (multifilamentary) superconductor—a composite superconductor consisting of at least one superconductive wire embedded in a matrix. **B 713, B-1**

flux density—see **magnetic induction.**

fully transposed conductor—a conductor in which every strand occupies every relative position in the conductor at regularly specified intervals along its length. **B 713, B-1**

magnetic field strength—the measured intensity of a magnetic field at a point, usually expressed in oersteds or amperes per metre. **E 269, E-7**

magnetic flux, Φ—the product of the magnetic induction, B, and the area of a surface (or cross section), A, when the magnetic induction B is uniformly distributed and normal to the plane of the surface.

$$\Phi = BA$$

where:
Φ = magnetic flux,
B = magnetic induction, and
A = area of the surface.

NOTE 2—If the magnetic induction is not uniformly distributed over the surface, the flux, Φ, is the surface integral of the normal component of B over the area.

$$\Phi = \int \int_s B \cdot dA$$

NOTE 3—Magnetic flux is a scalar and has no direction. **A 340, A-6**

magnetic flux jump—the collective, discontinuous motion of magnetic flux lines in a superconductor, produced by mechanical, thermal, magnetic, or electrical disturbances. **B 713, B-1**

magnetic flux pinning—the trapping of magnetic flux lines at defects in the superconducting material. **B 713, B-1**

magnetic induction (also flux density), B—that magnetic vector quantity which at any point in a magnetic field is measured either by the mechanical force experienced by an element of electric current at the point, or by the electromotive force induced in an elementary loop during any change in flux linkages with the loop at the point.

NOTE 4—If the magnetic induction, B, is uniformly distributed and normal to a surface or cross section, then the magnetic induction is:

$$B = \frac{\Phi}{A}$$

where:
B = magnetic induction,
Φ = total flux, and
A = area.

NOTE 5—B_{in} is the instantaneous value of the magnetic induction and B_m is the maximum value of the magnetic induction. **A 340, A-6**

matrix of composite superconductor—the continuous longitudinal phase of a pure metal, a polyphase alloy, or mechanical mixture that is not in the superconducting state at the normal operating conditions of the embedded superconductor. **B 713, B-1**

mixed matrix of composite superconductor—matrix composed of more than one component. **B 713, B-1**

normal state—the thermodynamic state in which a superconductive material no longer exhibits any of the characteristics of the superconducting state. **B 713, B-1**

quench—the abrupt and uncontrolled loss of superconductivity produced by a disturbance. **B 713, B-1**

stabilizer—a metal, but not necessarily the matrix, in electrical contact with a superconductor, to act as an electric shunt in the event that the superconductor reverts to the normal state.