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AMERICAN SOCIETY FOR TESTING AND MATERIALS
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Standard Test Method for D-C Critical Current of Composite Superconductors[1]

This standard is issued under the fixed designation B 714; 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.

1. Scope

1.1 This test method covers the procedure for the determination of the d-c critical current of composite superconductors.

1.2 This method is intended for use with superconductors having a critical current of less than 600 A under test conditions and at magnetic fields of less than 0.8 of the upper critical magnetic field.

1.3 *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 and health practices and determine the applicability of regulatory limitations prior to use.* Specific hazard statements are given in Section 6.

2. Referenced Documents

2.1 *ASTM Standards:*

B 713 Terminology Relating to Superconductors[2]

3. Terminology

3.1 Refer to Terminology B 713 for general terminology for the field of superconductivity.

4. Summary of Test Method

4.1 A direct current is applied to the superconductor specimen and the voltage generated along a section of the specimen is measured. The current is increased from zero and the voltage-current characteristic is generated. The critical current is defined as the current at which a specified electric field is exceeded in the specimen.

5. Significance and Use

5.1 The critical currends of composite superconductors are used to establish design limits for applications of superconducting wires. The operating conditions of superconductors in these applications determine much of their behavior and tests made with this method may be used to provide part of the information needed to determine the suitability of a specific superconductor.

5.2 Results obtained from this method can also be used for detecting changes in the superconducting properties of a composite superconductor due to processing variables, handling, aging, or other application or environmental conditions. This method is useful for quality control, acceptance, or research testing if the precautions below are observed.

5.3 The critical current of composite superconductors depends on many variables. These variables need to be considered in both the testing and the application of these materials **(1).**[3]

5.3.1 Test conditions such as magnetic field, temperature and relative orientation of specimen, current and magnetic field are determined by the particular application.

5.3.2 The test configuration may be determined by the particular conductor through the tolerances required by 8.1 and 8.4.

5.3.3 The specific critical current criterion may be determined by the particular application.

5.3.4 It may be appropriate to measure a number of test specimens if there are irregularities in testing.

5.4 A precaution is needed in the interpretation of results when the reference line of the *V-I* curve (8.5, 8.5.1) has a finite slope. The current transfer correction is to be used to correct for a true current transfer. Voltages may occur from other sources.

5.4.1 A current transfer voltage will result from having a voltage tap near (near is determined by resistivity of the matrix and electrical field criterion) to a current contact, or having a gradient in the magnetic field near the region between voltage taps, or having a field-sample orientation change near the region between voltage taps **(1, 2, 3).**

6. Hazards

6.1 Very large direct currents with very low voltages do not necessarily provide a direct personal hazard, but accidental shorting of the leads with another conductor, such as tools or transfer lines, can release significant amounts of energy and cause arcs or burns. Care must be taken to isolate and protect current leads from shorting. Also the stored energy in superconducting magnets commonly used for the background magnetic field can cause similar large current pulses or deposit

[1] This test method is under the jurisdiction of ASTM Committee B-1 on Electrical Conductors and is the direct responsibility of Subcommittee B01.08 on Superconductors.

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[2] *Annual Book of ASTM Standards*, Vol 02.03.

[3] The boldface numbers in parentheses refer to the list of references at the end of this test method.