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NATIONAL STANDARD OF THE PEOPLE'S REPUBLIC OF CHINA

GB/T 38841-2020

Mechanical properties measurement - Room temperature tensile test of reacted Nb3Sn composite superconductors

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Foreword

This standard was drafted in accordance with the rules given in GB/T 1.1-2009.

This standard uses the translation method equivalent to the use of IEC 61788-19.2013 "Superconductivity Part 19.Mechanical properties measurement after reaction

Room temperature tensile test method of Nb3Sn composite superconducting wire".

The documents in my country that have a consistent correspondence with the normative references in this standard are as follows.

---GB/T 228.1-2010 Metallic materials tensile test Part 1.Room temperature test method (ISO 6892-1.2009,

MOD)

---GB/T 2900.100-2017 Electrical engineering term superconductivity (IEC 60050-815.2015, IDT)

---GB/T 12160-2019 Calibration of extensometer system for uniaxial test of metal materials (ISO 9513.2012, IDT)

---GB/T 13634-2019 Calibration of standard dynamometer for inspection of metal material uniaxial testing machine (ISO 376.2011, IDT)

---GB/T 16825.1-2008 Inspection of static uniaxial testing machine Part 1.Tension and/or pressure testing machine force measurement system

Traditional inspection and calibration (ISO 7500-1.2004, IDT)

This standard has made the following editorial changes.

---Modified the standard name.

Please note that some content of this document may involve patents. The issuer of this document does not assume responsibility for identifying these patents.

This standard was proposed by the Chinese Academy of Sciences.

This standard is under the jurisdiction of the National Superconducting Standardization Technical Committee (SAC/TC265).

This standard was drafted by. Western Superconducting Materials Technology Co., Ltd., Guangdong Power Grid Co., Ltd., Chinese Academy of Sciences

Institute, Institute of High Energy Physics, Chinese Academy of Sciences, Institute of Electrical Engineering, Chinese Academy of Sciences.

Introduction

Cu/Nb3Sn superconducting wire is a multi-core composite superconducting material, which can be prepared by different methods. the first is the bronze method, which combines Nb/Nb

The gold filaments are embedded in the bronze matrix, barrier layer and copper stabilizer. The second is the inner tin method, which is stabilized by a multi-core filament containing a tin reservoir layer, a barrier layer and copper

Body composition. The third is the powder tube method. Nb/Nb alloy tubes are filled with tin-rich powder and embedded in the copper stabilizer.

The common process of all types of Nb3Sn composite wires is that after reaching the final finished wire size, it needs to be formed after several days of heat treatment

For Nb3SnA15 phase, the heat treatment can be one or more times and the temperature of the last heat treatment is about 640 degrees C or above. The superconducting phase is very brittle,

It is easy to cause the core wire to break, which is accompanied by the decrease of superconductivity.

Commercial composite superconducting wire has the characteristics of high current density and small cross-sectional area, which is mainly used to make superconducting magnets, which can superconductor

Winding on the skeleton, and then heat treatment with the skeleton (winding first and then reacting), or superheating the superconductor first, and then winding

Make a magnet (reaction first and then winding). When winding the magnet, complex stresses will be imposed on the magnet winding, so in the actual manufacturing process, the

Less use the method of first reaction and then winding.

If you need to test the mechanical properties of the composite superconductor before the reaction and have not formed a superconducting phase, you can also use this standard, or

use

Use IEC 61788-6.

When the magnet is energized and excited, due to the high current density of the superconducting wire, a large electromagnetic force will be applied to the wire. If the first reaction followed by winding

For the magnet preparation method, the strain and stress levels of the winding will be greatly restricted.

Therefore, to determine the mechanical properties of the Nb3Sn composite superconducting wire in the superconducting phase after the reaction is a prerequisite for making superconducting magnets.

Nb3Sn after reaction

Room temperature tensile test method of composite superconducting wire

1 Scope

This standard specifies the principle, device, sample preparation, test conditions, room temperature tensile test method of the Cu/Nb3Sn composite superconducting wire after reaction

Result calculation, measurement uncertainty, test report.

This test method is used to measure the elastic modulus and specified plastic elongation strength by the stress-strain curve (composed of copper and copper-tin in the composite

(Subject to yield).

In addition, the elastic limit, tensile strength and elongation after breaking can be measured by this method. According to the international cycle comparison test report, the elastic limit and

The measurement of elongation after breaking has great uncertainty, so these physical quantities are selected.

This standard is suitable for measuring round or rectangular with a cross-sectional area of 0.15mm2~2.0mm2 and a copper-non-copper volume ratio of 0.2~1.5

A cross-section sample without insulation coating.

2 Normative references

The following documents are essential for the application of this document. For dated reference documents, only the dated version applies to this article

Pieces. For the cited documents without date, the latest version (including all amendments)

applies to this document.

ISO 376 Calibration of standard dynamometer for metal material uniaxial testing machine inspection (Metalicmaterials-Calibrationof

force-provinginstrumentsusedfortheverificationofuniaxialtestingmachines)

ISO 6892-1 Tensile Test of Metallic Materials Part 1.Room Temperature Test Method (Metalicmaterials-Tensile

testing-Part 1.Methodoftestatroomtemperature)

Inspection of ISO 7500-1 static uniaxial testing machine for metallic materials. Part 1.Tension and/or pressure testing machine force measurement system

Inspection and calibration (Metalicmaterials-Verificationofstaticuniaxialtestingmachines-Part 1.Tension/

compressiontestingmachines-Verificationandcalibrationoftheforce-measuringsystem)

ISO 9513 Calibration of Extensometer for Metal Material Uniaxial Test (Metalic materials-Calibration of

extensometersusedinuniaxialtesting)

IEC 60050 (all parts) International electrotechnical vocabulary

3 Terms and definitions

The terms and definitions defined by IEC 60050-815 and ISO 6892-1 and the following apply to this document.

3.1

Tensile stress

The quotient of the tensile force at any moment during the test divided by the original cross-sectional area of the specimen.

3.2

Strain

The quotient of the displacement increment at any time during the test divided by the initial gauge length of the extensometer.