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**NATIONAL STANDARD OF THE
PEOPLE'S REPUBLIC OF CHINA**

GB/T 12963-2022

Replacing GB/T 12963-2014

Electronic-grade polycrystalline silicon

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Foreword

This Document was drafted as per the rules specified in GB/T 1.1-2020 Directives for Standardization - Part

1.Rules for the Structure and Drafting of Standardizing Documents. This Document replaced GB/T 12963-2014 Electronic-Grade Polycrystalline Silicon. Compared with GB/T 12963-2014, the major technical changes of this Document are as follows besides the structural adjustments and editorial modifications.

a) Change the scope of application (see Clause 1 of this Edition; Clause 1 of the 2014 Edition);

b) Change the designation requirements (see

4.1 of this Edition;

4.1.1 of the 2014 Edition);

c) Change the product grade (see

4.2 of this Edition;

4.1.2 of the 2014 Edition);

d) Change the technical indicators of different grades of electronic grade polycrystalline silicon (see 5.1 of this Edition;

4.2 of the 2014 Edition);

e) Change the structural requirements (see

5.3 of this Edition;

4.4 of the 2014 Edition);

1 Scope

China's national standard for electronic-grade polycrystalline silicon - the feedstock from which semiconductor silicon crystals are grown, and one of the purest materials manufactured at industrial scale anywhere. It specifies the designations and categories, the technical requirements, the test methods, the inspection rules, the marking, packaging, transport and storage, and the accompanying documents for electronic-grade polysilicon. What separates electronic grade from the solar grade made in the same plants is purity, by a wide margin: a semiconductor wafer's electrical behaviour is engineered by introducing dopant atoms at concentrations of parts per billion, which only works if the silicon they are introduced into is purer than that. An unintended donor or acceptor at the same level as the intended one simply falsifies the result, and metallic contamination degrades the carrier lifetime and destroys the devices made from the wafer. The requirements are therefore expressed in the terms the crystal grower and the device maker work in rather than as a percentage purity: the resistivity of a test crystal grown from the material, which is the practical measure of the net electrically active impurity; the donor and acceptor concentrations separately, since they compensate each other and a net figure conceals both; the carbon and oxygen content; the minority carrier lifetime; and the metallic impurities determined individually. The surface contamination and the packaging matter as much as the bulk analysis, because polysilicon is broken into chunks and handled, and the surface is where contamination arrives - which is why the packaging and the accompanying documents are part of the specification rather than logistics. Issued on 30 December 2022 and in force since 1 July 2023, it replaces GB/T 12963-2014.

This Document stipulates the designations and categories, technical requirements, test methods, inspection rules, marking, packaging, transportation, storage, accompanying documents and order form content of electronic grade polycrystalline silicon. This Document applies to electronic grade polycrystalline silicon (hereinafter referred to as "polycrystalline silicon") produced from chlorosilane and silane.

2 Normative References

The provisions in following documents become the essential provisions of this Document through reference in this Document. For the dated documents, only the versions with the dates indicated are applicable to this Document; for the undated documents, only the latest version (including all the amendments) is applicable to this Document.

GB/T 1550 Test methods for conductivity type of extrinsic semiconducting materials

GB/T 1551 Test method for measuring resistivity of monocrystal silicon - In-line four- point probe and direct current two-point probe method

GB/T 1553 Test methods for minority carrier lifetime in bulk silicon and germanium - Photoconductivity decay method

GB/T 1557 Test method for determining interstitial oxygen content in silicon by infrared absorption

GB/T 1558 Test method for substitutional carbon content in silicon by infrared absorption

GB/T 4059 Polycrystalline silicon - Examination method - Zone-melting on phosphorus under controlled atmosphere

GB/T 4060 Polycrystalline silicon - Examination method - Vacuum zone-melting on boron

3 Terms and Definitions

For the purposes of this Document, the terms and definitions given in GB/T 14264 apply.

4 Designation and Category

4.1 The designation indication of polycrystalline silicon shall comply with the provisions of GB/T 14844.

5 Technical Requirements

5.1 Technical indicators The grade and related technical indicators of polycrystalline silicon shall comply with the provisions of Table 1.

5.2 Dimensions and tolerances

5.2.1 Bulk polycrystalline silicon has an irregular shape and random size distribution; and its linear size shall be 6mm~150mm. When mixing, silicon blocks with a linear size less than 6mm shall not exceed 1% of the total weight; if there are other dimensions requirements, it shall be determined through negotiation between the supplier and the purchaser.

5.3 Structure Polycrystalline silicon shall be free of oxidation interlayers and temperature interlayers.

5.4 Surface quality

5.4.1 The surface structure of polycrystalline silicon shall be dense and smooth, and the edge particles on the cross-section shall be no larger than 3mm.

5.4.2 The appearance of polycrystalline silicon shall be free of stains, discoloration and visible contaminants.

6 Test Methods

6.1 Before testing polycrystalline silicon for donor impurity content, acceptor impurity content, carbon content, conductivity type, resistivity, minority carrier lifetime, and oxygen content, the polycrystalline silicon shall be made into a monocrystalline specimen according to the methods in GB/T 4059, GB/T 4060 or GB/T 29057.

6.4 The inspection of the basis metal impurity content of the polycrystalline silicon shall be carried out in accordance with the provisions of GB/T 37049.

6.5 The inspection of surface metal impurity content of polycrystalline silicon shall be carried out in accordance with the provisions of GB/T 24582.

6.6 The inspection of conductivity type of polycrystalline silicon shall be carried out in accordance with the provisions of GB/T 1550.

6.7 The inspection of resistivity of polycrystalline silicon shall be carried out in accordance with the provisions of GB/T 1551.

6.10 The size distribution range of bulk polycrystalline silicon is tested by screening. The dimensions and deviations of rod-shaped polycrystalline silicon are measured with measuring tools of corresponding accuracy.

6.11 The inspection of polycrystalline silicon structure (oxidation interlayer, temperature interlayer) shall be carried out in accordance with the provisions of GB/T 4061.

6.12 The particle size of the cross-section edge of polycrystalline silicon shall be measured with measuring tools of corresponding accuracy, and other surface quality shall be visually inspected.

7.1 Inspection and acceptance

7.1.1 The product shall be inspected by the supplier or a third party to ensure that the product quality complies with the provisions of this Document and the order form.

7.2 Batching Products shall be submitted for acceptance in batches; and each batch shall be composed of polycrystalline silicon produced with the same specifications, the same grade, and the same process.

7.3 Inspection items

7.3.1 Each batch of products shall be inspected for the following items including donor impurity content, acceptor impurity content, carbon content, basis metal impurity content, surface metal impurity content, size and tolerance, structure, and surface quality.

7.4 Sampling and sample preparation