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

GB/T 20042.6-2024

Replacing GB/T 20042.6-2011

**Proton exchange membrane fuel cells - Part 6: Test methods for
bipolar plate characteristics**

质子交换膜燃料电池 第6部分：双极板特性测试方法

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Table of Contents

1	Scope
2	Normative References
3	Terms and Definitions
4	Flexural Strength Test of Bipolar Plate Materials
4.2	Preparation of the sample
4.3	Test methods
5	Density Test of Bipolar Plate Materials
5.2	Preparation of sample
6	Resistance Test of Bipolar Plate Material
6.2	Preparation of sample
6.3	Test methods
6.3.1	In-plane resistivity test
6.3.2	Through-plane resistivity test
6.3.3	Contact resistance test
6.4	Data processing
7	Corrosion Current Density Test of Bipolar Plate Materials
7.2	Preparation of sample
7.3	Test methods
7.3.1	Open circuit potential test
7.3.2	Dynamic potential test
7.3.3	Constant potential test
8	Area Utilization Rate Test of Bipolar Plate Component
8.2	Preparation of Sample
8.3	Test methods
9	Thickness Uniformity Test of Bipolar Plate Component
9.2	Preparation of sample
9.3	Test methods
9.4	Data processing
10	Groove Depth Uniformity Test of Bipolar Plate Component...
11	Flatness Test of Bipolar Plate Components...
12	Relative Flatness Test of Bipolar Plate Component...
13	Contact Resistance Test of Bipolar Plate Component...

- 14 Air Tightness Test of Bipolar Plate Component...
- 15 Water Contact Angle Test of Bipolar Plate Component...
- 16 Coating Thickness Test of Bipolar Plate Component...
- 17 Coating Bonding Strength Test of Bipolar Plate Component...
- 18 Corrosion Current Density Test of Bipolar Plate Component...
- 19 Specific Heat Capacity Test of Bipolar Plate Component...
- 20 Thermal Conductivity Test of Bipolar Plate Component...
- 21 Precipitation Ion Composition and Concentration Test for Bipolar Plate Component ...

1 Scope

GB/T 20042.6-2024 specifies the test methods for the bipolar plate of a proton exchange membrane fuel cell. The bipolar plate is most of the mass and much of the cost of a stack, and it has to satisfy a set of requirements that pull against each other: conduct electricity through its thickness and across contact interfaces, conduct heat, be gas tight, resist corrosion in a hot acidic oxidising environment for thousands of hours, and be thin and cheap. The standard fixes how each of those is measured, which matters because metal and graphite composite plates are compared against each other on these numbers: the through-plane and interfacial contact resistance and the load at which it is measured, the gas permeability, the corrosion current under simulated anode and cathode conditions and the resulting ion release, the surface contact angle, the thermal conductivity, the flexural and compressive strength, the density and the dimensional and flatness measurements. The 2024 edition replaces GB/T 20042.6-2011. For a plate maker or a stack builder in China, this is the basis of comparison.

This Document specifies the test methods for the flexural strength, density, resistance and corrosion current density, etc. of bipolar plate materials for proton exchange membrane fuel cells; and the test methods for the area utilization, thickness uniformity, groove depth uniformity, flatness, relative flatness, contact resistance, air tightness, etc. of bipolar plate components. This Document is applicable to various types of bipolar plate materials and components for proton exchange membrane fuel cells. NOTE. The definitions of bipolar plate materials and bipolar plate components are as follows:

- a) Bipolar plate material. Plate material in the same state as the finished bipolar plate material;
- b) Bipolar plate component. Finished bipolar plate in the same state as the used state.

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 230.2 Metallic materials - Rockwell hardness test - Part

3 Terms and Definitions

For the purposes of this Document, the terms and definitions given in GB/T 20042.1-2017 and the following apply.

3.1 Corrosion current density The current value that is generated by the electrochemical damage caused by the corrosion potential on the surface of the bipolar plate material or component per unit area in the simulated fuel cell operating environment.

3.2 Interfacial contact resistance The resistance that is generated by the contact between the two material detection areas.

3.3 Through-plane resistivity The resistivity value of the bipolar plate material in the direction perpendicular to the plate surface. NOTE. The unit of through-plane resistivity is milliohm centimeters (m Ω ·cm).

3.4 In-plane resistivity The resistivity value of the bipolar plate material in the direction parallel to the plate surface.

Note. The unit of in-plane resistivity is milliohm centimeters (m Ω ·cm).

3.5 Flexural strength The maximum bending stress that a bipolar plate can withstand during bending under specified conditions.

3.6 Flatness The sum of the distances from the highest peak and the lowest valley on the surface of the measured part of the bipolar plate to the fitting plane under the specified pressure.

4 Flexural Strength Test of Bipolar Plate Materials

4.1 Test instruments The test instruments include the following equipment and tools.

4.2 Preparation of the sample

4.2.1 The width of the sample is $25\text{mm} \pm 0.5\text{mm}$ and the length is $60\text{mm} \pm 1\text{mm}$. The sample size can also be determined by negotiation between the two parties. The deviation between the thickness of the sample on each part and the average thickness should not exceed 2%; and the deviation between the width and the average width shall not exceed 3%. The cross section of the sample shall be rectangular and without chamfers.

4.2.2 The number of samples is 5 (ensure 3 valid values to be obtained); and there shall be

no wrinkles, scratches or damage.

4.2.3 For samples from different batches, they shall be sampled separately.

4.3 Test methods

4.3.1 Measure the width and thickness 3 times along the length of the sample; and take the average value respectively.

4.3.2 Adjust the support span to $40\text{mm} \pm 0.3\text{mm}$; place the prepared sample symmetrically on the two supports; and make the test machine pressure head and support axis perpendicular to the sample; and test the sample bending strength using the three-point bending method in accordance with GB/T 13465.2.

4.3.3 The pressure head applies load to the sample uniformly at a loading speed of 1 mm/min until the sample breaks; and the breaking load value is read.

4.4 Data processing The flexural strength of the sample is calculated according to Formula (1).

5 Density Test of Bipolar Plate Materials

5.1 Test instrument The test instrument includes the following equipment and tools.

5.2 Preparation of sample

5.2.1 The sample shape is square ($5\text{cm} \times 5\text{cm}$) and the area is 25cm^2 ; the sample shape and size can also be negotiated by both parties to the test.

5.2.2 Clean the sample surface with ethanol or other solvents and dry it.

5.2.3 Remove grease from the metal wire.

5.3 Test methods The test is carried out according to the method specified in

4.2.3 of GB/T 4472-2011 for hydrostatic weighing method.

5.4 Data processing The density data of the sample is processed according to the method specified in

4.2.3.4 of GB/T 4472-2011.

6 Resistance Test of Bipolar Plate Material

6.1 Test instrument The test instrument includes the following equipment and tools.

6.2 Preparation of sample

6.2.1 The sample shape is square ($5\text{cm} \times 5\text{cm}$) and the area is 25cm^2 ; the sample shape