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Replacing GB/T 20042.1-2005

Proton exchange membrane fuel cell –

Part 1: Terminology

质子交换膜燃料电池 第 1 部分：术语

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Foreword

GB/T 20042 “Proton exchange membrane fuel cell” is divided into the following 7 parts:

- Part 1: Terminology;
- Part 2: General technical specification of fuel cell stacks;
- Part 3: Test method for proton exchange membrane;
- Part 4: Test method of electrocatalyst;
- Part 5: Test method of membrane electrode;
- Part 6: Test method of bipolar plate properties;
- Part 7: Test method of carbon paper properties.

This part is part 1 of GB/T 20042.

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

This part replaces GB/T 20042.1-2005 “Proton exchange membrane fuel cell - Terminology”. As compared with GB/T 20042.1-2005, the main technical changes are as follows:

- ADJUST the classification of terminology, from the original seven categories to five major categories and eleven subcategories;
- INCREASE the terms and definitions from the original 93 to 219.

This part was proposed by the China Electrical Appliance Industry Association.

This part shall be under the jurisdiction of the National Fuel Cell and Liquid Flow Standardization Technical Committee (SAC/TC 342).

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Proton exchange membrane fuel cell –

Part 1: Terminology

1 Scope

This part defines the terms and definitions used for proton exchange membrane fuel cell technology and its application field.

This part applies to various types of proton exchange membrane fuel cells.

2 Physical and abstract

2.1 Materials

2.1.1

Hydrogen storage material

Materials that can absorb, store, and release hydrogen when needed under certain conditions.

2.1.2

Electrocatalyst

A substance that speeds up the electrode reaction process but is not consumed by itself.

2.1.3

Non-precious metal catalyst

Catalyst that does not contain any precious metal component.

Note: Precious metal elements include: Osmium (Os), Iridium (Ir), Ruthenium (Ru), Rhodium (Rh), Platinum (Pt), Palladium (Pd), Gold (Au), Silver (Ag).

2.1.4

Alloy catalyst

A catalyst consisting of an alloy of two or more metals.

A proton exchange membrane in which all hydrogen atoms in the polymer chain are replaced by fluorine atoms.

2.1.13

Composite membrane

A membrane which consists of two or more materials.

2.1.14

Carbon cloth

A porous cloth woven from carbon fiber.

2.1.15

Carbon paper

A porous paper-like profile formed by bonding uniformly dispersed carbon fibers together (by the use a carbonizable binder).

2.1.16

Fuel

The substance which can be oxidized at the anode to produce free electrons.

2.1.17

Raw fuel

The unreformed fuel which is supplied from an external source to the fuel cell power generation system.

2.1.18

Reformate

The hydrogen-rich gas converted from the raw fuel through the fuel reforming system.

2.1.19

Oxidant

The substance which can get electrons at cathode to be reduced.

2.1.20

2.2.18

Stack wiring lead

The output terminal of the fuel cell stack that supplies power to the outside, which is also referred to as the cell stack terminal.

2.2.19

Manifold

A pipe that supplies fluids to the fuel cell or fuel cell stack or otherwise collects from the fuel cell or fuel cell stack and drain it.

Note 1: The design of the external manifold is for single cells that are stacked together. The gas mixture is sent from a central source to the inlet of large fuel and oxidant. The inlet covers the immediate end of the stack and is sealed with a properly designed gasket. Similar systems collect exhaust gas at the opposite end.

Note 2: The internal manifold is an internal channel formed by the assembly of bipolar plates, MEAs, and gaskets, which is used for the delivery and/or removal of reactants and/or reaction products for each cell. The stack of some structures also includes internal manifolds that deliver and remove coolant.

2.3 Battery/system

2.3.1

Single cell unit cell

The basic unit of a fuel cell which consists of a group of membrane electrode assemblies and corresponding unipolar or bipolar plates.

Note: In general, a single cell in a stack is called unit cell, and a single cell with an independent structure is called single cell.

2.3.2

Fuel cell

An electrochemical device that directly converts the chemical energy of an externally supplied fuel and oxidant into electrical energy (direct current) and generates heat and reaction products.

2.3.3

Regenerative fuel cell

Fuel supply system/module

A system or module that provides fuel storage, supply, and regulation functions for a fuel cell system.

2.4.7

Thermal management system/module

The system and module which is to provide cooling, heat dissipation and/or heating, and may also provide for excess heat reusing to ensure that the temperature of various internal modules is within normal range when the fuel cell system is in operation.

2.4.8

Water management system/module

A system or module that manages to maintain the water required for the relevant modules inside the fuel cell system to meet its normal operating requirements and may also be used to achieve the reuse of water.

2.4.9

Water treatment system/module

A system or module used to perform the necessary treatment of recycled or make-up water used in fuel cell systems.

2.4.10

Exhaust treatment system/module

The system or module for treating the exhaust gas discharged from the stack to achieve the relevant discharge standard, which is mainly to remove or dilute the non-reactive fuel in the anode exhaust gas.

2.4.11

Oxidant treatment system/module

The system or module that meters, regulates, and processes the input oxidant to facilitate the use by the fuel cell power system.

2.4.12

Balance of plant; BOP

The general term for all components of a fuel cell system other than the fuel

(Membrane) swelling rate

The ratio of dimensional change in the transverse, longitudinal and thickness directions with respect to the dry membrane at a given temperature and humidity, expressed in %.

3.1.11

Proton conductivity

The proton conductivity of the membrane which is characterized by the current density that the membrane can conduct at a unit electric field strength, in units of S/cm.

3.1.12

Gas permeability

The amount of gas which passes through unit area and unit thickness of article under the unit pressure per unit time.

3.1.13

Porosity

The ratio of the volume of all holes in an article to the geometric volume of the article.

Note: In proton exchange membrane fuel cells, porosity is one of the characteristic parameters of the catalyst layer, microporous diffusion layer, and gas diffusion layer.

3.1.14

Internal resistance (fuel cell internal resistance)

The ohmic resistance inside the fuel cell caused by electronic and ion resistance.

Note: Ohmic means that the relationship between voltage drop and current obeys Ohm's law.

3.1.15

Lower flammable limit

The lowest concentration (volume fraction) of a combustible gas or steam that can be ignited in a homogeneous mixture with the combustion supporting gas and can transmit the flame.

The DC power output from the fuel cell stack.

3.2.19

Net power

The power generated by a fuel cell power system which can be used externally.

3.2.20

Minimum power

The minimum net electric power that the fuel cell power system can output under continuous stable operation.

3.2.21

Peak power

The maximum power not less than the rated power generated by the fuel cell stack or power generation system within a predetermined short time period.

3.2.22

Auxiliary electrical power

The external electrical power consumed by the fuel cell system.

3.2.23

Auxiliary thermal power

The external thermal power consumed by the fuel cell system.

3.2.24

(Electrode) area power density

The power generated by the active area of the unit electrode.

3.2.25

Volumetric power

The ratio of the rated power of a stack or fuel cell power system to its volume.

Note: Volumetric power is often referred to as power density.

The percentage of the actual amount of fuel or oxidant required to output current (calculated in accordance with Faraday's law) to the total amount of fuel or oxidant entering the fuel cell.

Note: The reactant utilization rate is reciprocal to the reactant measurement ratio.

3.3.3

Fuel consumption

The amount of fuel consumed by the power generation system within a specified period of time under certain conditions.

3.3.4

Fuel consumption rate

The amount of fuel consumed by the power generation system per unit time and per unit of power under certain conditions, in units of g/(kW • h).

3.3.5

Oxidant consumption

The amount of oxidant consumed by the power generation system within a specified period of time under certain conditions.

3.3.6

Water consumption rate

The amount of water consumed by the power generation system per unit time and per unit of power, which is the difference between the amount of water consumed and the amount of water recovered, in the unit of g/kWh.

3.3.7

Hydrogen compressibility factor

A parameter used to correct the amount of compressed hydrogen which is calculated in accordance with the ideal gas law, expressed as Z, the corrected formula is n = PV/(RTZ). The greater the pressure, the greater the Z value.

3.3.8

Back pressure

power to the time when the power or thermal output power reaches to the setting value steady state tolerance range.

3.3.15

Rated power response time

The time interval from the start-up of the fuel cell system to the time when the electrical or thermal output power reaches the steady state tolerance range of the rated power.

3.3.16

90% rated power response time

The time interval from the start-up of the fuel cell system to the time when the electrical or thermal output power reaches 90% of the rated power steady state tolerance range.

3.3.17

Startup energy

The sum of the electrical energy, thermal energy, and/or chemical (fuel) energy required by the fuel cell power system during startup.

4 Reaction process and phenomena, nature

4.1 Reaction process

4.1.1

Electrocatalysis

The heterogeneous catalytic process of the charge transfer reaction which occurs at the interface between the electrode's electrocatalyst and the electrolyte.

4.1.2

Hydrogen oxidation reaction; HOR

The electrochemical half-reaction of hydrogen when it is oxidized at the anode to lose electrons.

4.1.3

Oxygen reduction reaction; ORR

4.1.10

Electro-osmosis

The process that the liquid molecules in the solvent or solid electrolyte move with the ions in the electrolyte under the action of the electric field between the positive and negative electrodes.

4.1.11

Activation/conditioning

The process of operating the fuel cell under set conditions to achieve design performance or optimal performance.

4.1.12

Reforming

The chemical process for preparing a hydrogen-rich gas mixture from a raw fuel.

4.1.13

Internal reforming

The reforming reaction that occurs inside the fuel cell stack.

Note: The reforming zone may be separated from the anode of the fuel cell, but both are in close proximity (indirectly inside); or it may be the anode itself (directly inside).

4.1.14

Hydrogen production via reforming

The process of hydrocarbon feedstocks which are catalytically reacted within the reformer to obtain hydrogen.

4.1.15

Steam reforming

The process of producing hydrogen-rich gas by chemical reaction of raw fuel (such as natural gas) and water vapor.

4.2 Phenomenon and nature

4.2.1

Cold start

The startup of fuel cell power system at ambient temperature.

5.1.6

Hot start

The startup of fuel cell power system when its module is in normal operating temperature range.

5.1.7

Load-following operation

The mode that the electric power or thermal power output by the fuel cell power system changes correspondingly with changes in the load, to control the system operation.

5.1.8

Constant current operation

The operation mode of fuel cell power system at constant current.

5.1.9

Constant voltage operation

The operation mode of the fuel cell power system to maintain constant output voltage.

5.1.10

Constant power operation

The operation mode of the fuel cell power system when its output power is maintained constant.

5.1.11

Grid-independent or isolated operation

The mode in which the fuel cell power system operates independently of any power grid.

Note: Grid-independent operation is also referred to as isolated operation.

5.1.12

Interlock

The control method of monitoring whether the specified conditions are met or not and ensuring that the associated control device performs the associated safety actions.

5.1.32

Stacking

The process of placing the cells adjacent to each other in series to form a fuel cell stack.

Note: Typically, single fuel cells are connected in series.

5.1.33

Natural ventilation

Air flow due to wind and/or temperature gradient effects.

5.1.34

Forced ventilation

The process of making air flow through mechanical means, after which the original air is replaced by fresh air.

5.2 State

5.2.1

Operational state

The state that the fuel cell power generation system has a power output.

5.2.2

Passive state

The state of the fuel cell power system in the stack where the fuel or oxidant chamber has been purged with water vapor, air, nitrogen, or a manufacturer-specified gas.

5.2.3

Hot state

The state at which the temperature of the constituent modules of the fuel cell power system is within the normal operating temperature range.