IEC/TS 62282-1

Edition 2.0 2010-04

TECHNICAL SPECIFICATION

SPÉCIFICATION TECHNIQUE

Fuel cell technologies –
Part 1: Terminology

Technologies des piles à combustible –
Partie 1: Terminologie

IEC/TS 62282-1:2010

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CONTENTS

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FUEL CELL TECHNOLOGIES –

Part 1: Terminology

FOREWORD

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Technical specifications are subject to review within three years of publication to decide whether they can be transformed into International Standards.

IEC 62282-1, which is a technical specification, has been prepared by IEC technical committee 105: Fuel cell technologies.

This second edition cancels and replaces the first edition, published in 2005. This second edition constitutes a technical revision.

The first edition of IEC TS 62282-1 was intended as a resource for the working groups of TC 105 and users of the TC 105 standards series; therefore it only included terms and definitions used in the other IEC 62282 standards to provide consistency among those documents. This second edition is a general fuel cell glossary, including all terms unique to fuel cell technologies, and it is a complete re-write of the previous edition.

The text of this technical specification is based on the following documents:

Enquiry draft	Report on voting
105/200/DTS	105/250/RVC

Full information on the voting for the approval of this technical specification can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- transformed into an International standard,
- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

FUEL CELL TECHNOLOGIES –

Part 1: Terminology

1 Scope

This part of IEC 62282 provides uniform terminology in the forms of diagrams, definitions and equations related to fuel cell technologies in all applications including but not limited to stationary power, transportation, portable power and micro power applications.

Not found here are words and phrases, which can be found in standard dictionaries, engineering references or the IEC 60050 series.

NOTE The first edition of IEC 62282 was intended as a resource for the working groups and users of the IEC TC 105 series of fuel cell standards. This second edition has been expanded into a general fuel cell glossary.

2 Diagrams of generalized fuel cell systems

2.1 Diagrams

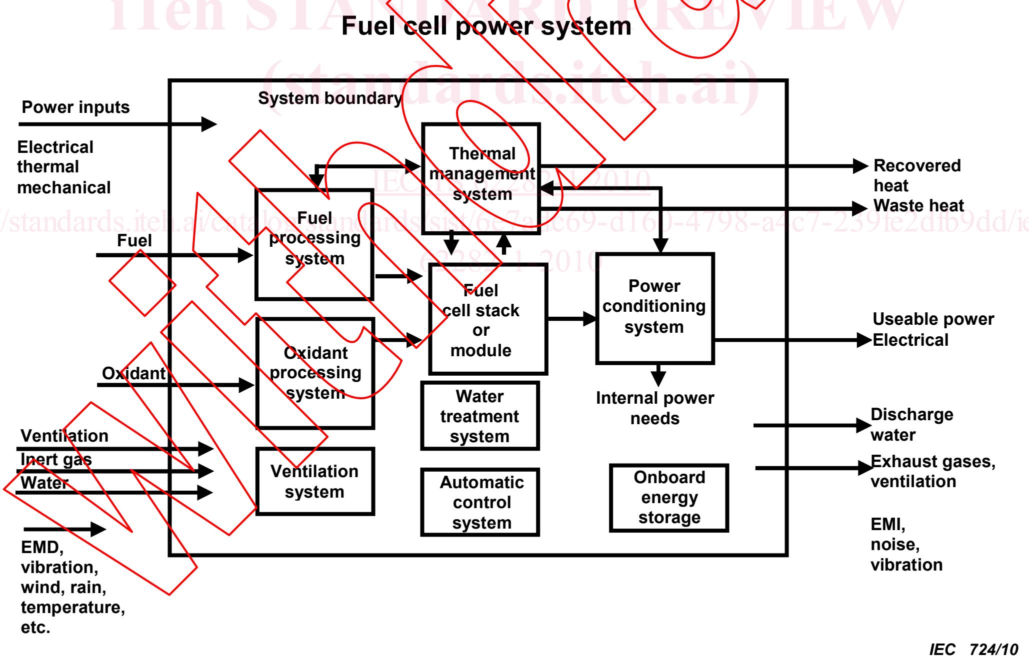


Figure 1 – Stationary fuel cell power systems (3.49.3)

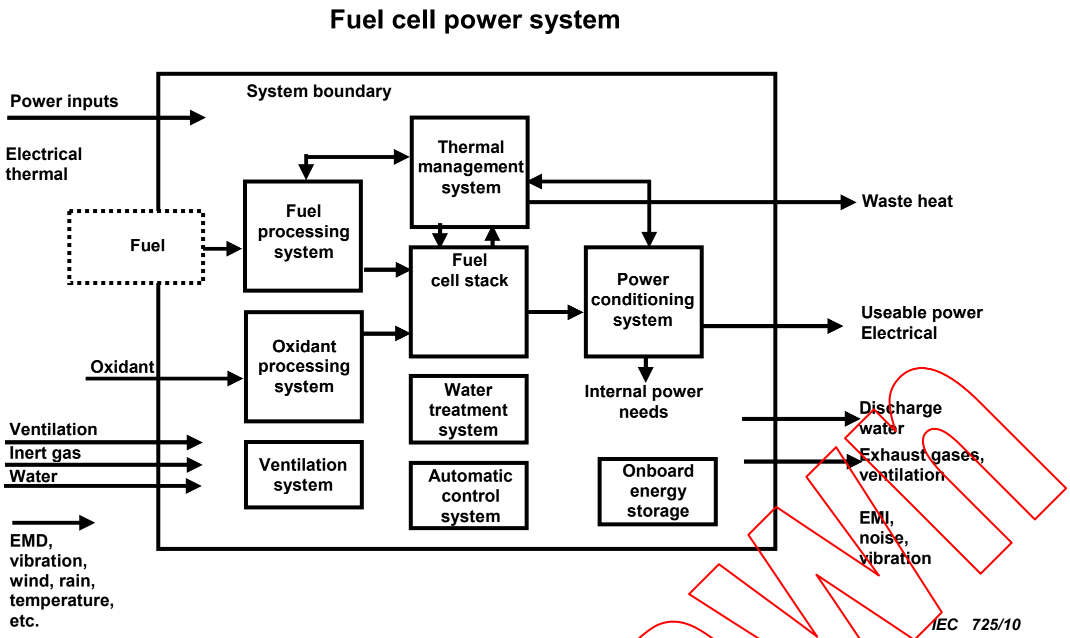
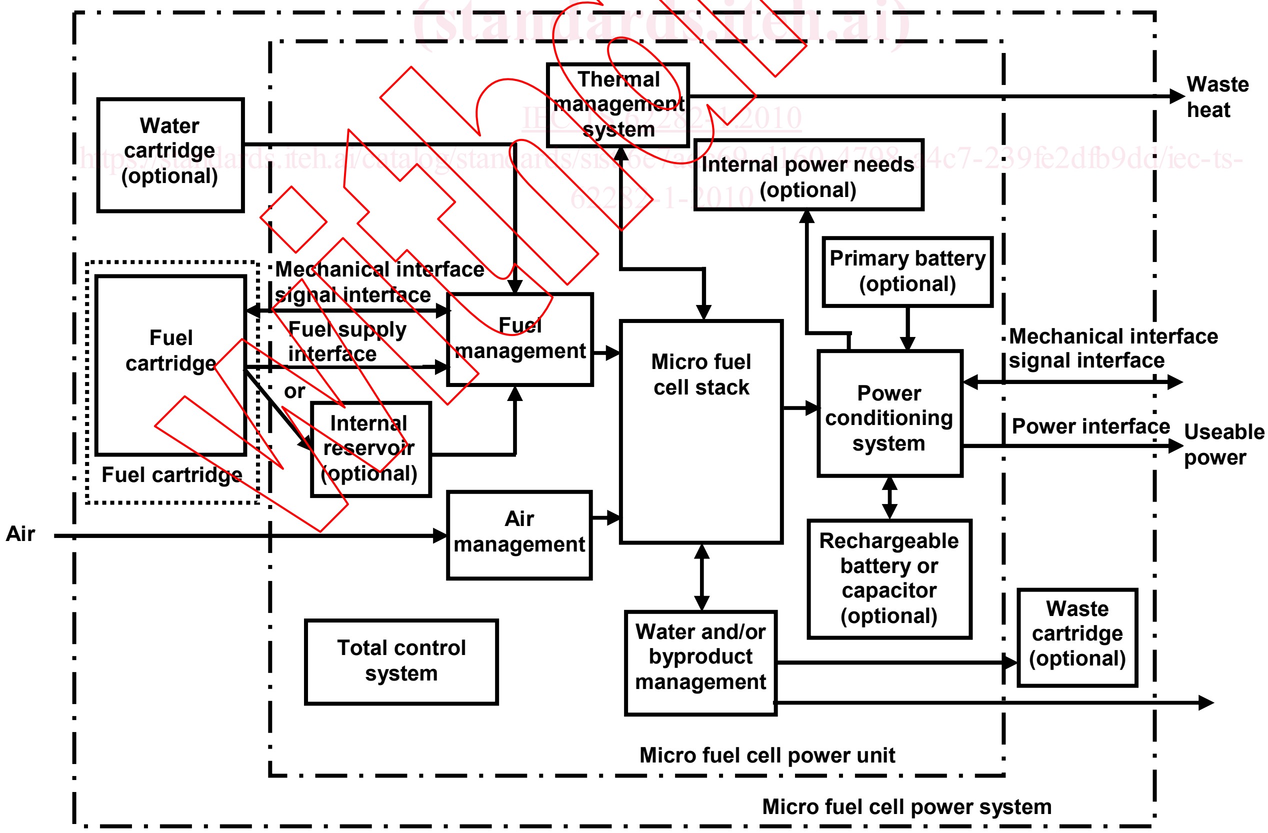
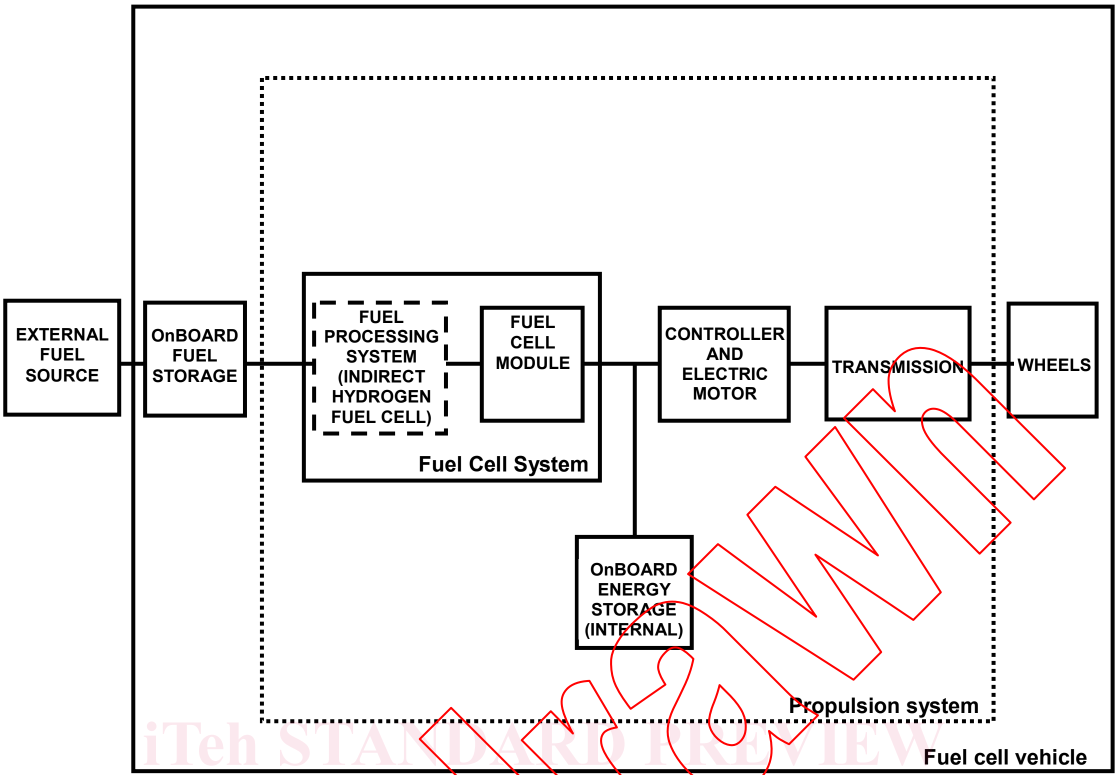


Figure 2 – Portable fuel cell power systems (3.49.2)



IEC 726/10

Figure 3 – Micro fuel cell power systems (3.49.1)



IEC 727/10

Figure 4 – Fuel cell vehicles (3.51)

2.2 Definition of diagram functions

The overall design of the power systems anticipated by this part of IEC 62282 are formed by an assembly of integrated systems, as necessary, intended to perform designated functions, as follows:

- Automatic control system – System that is composed of sensors, actuators, valves, switches and logic components that maintain the fuel cell power system (3.49) parameters within the manufacturer's specified limits without manual intervention.
- Fuel cell module – Equipment assembly of one or more fuel cell stacks (3.50) which electrochemically converts chemical energy to electric energy and thermal energy intended to be integrated into a vehicle or power generation system.
- Fuel cell stack – Equipment assembly of cells, separators, cooling plates, manifolds (3.70) and a supporting structure that electrochemically converts, typically, hydrogen rich gas and air reactants to DC power, heat and other reaction products.
- Fuel processing system – System of chemical and/or physical processing equipment plus associated heat exchangers and controls required to prepare, and if necessary, pressurize, the fuel for utilization within a fuel cell power system (3.49).
- Onboard energy storage – System of internal electric energy storage devices intended to aid or complement the fuel cell module (3.48) in providing power to internal or external loads.
- Oxidant processing system – System that meters, conditions, processes and may pressurize the incoming supply of oxidant for use within the fuel cell power system (3.49).
- Power conditioning system – Equipment that is used to adapt the electrical energy produced by the fuel cell stack(s) (3.50) to application requirements as specified by the manufacturer.

- Thermal management system – System that provides heating or cooling and heat rejection to maintain the fuel cell power system (3.49) in the operating temperature range, and may provide for the recovery of excess heat and assist in heating the power train during startup.
- Ventilation system – System that provides air through forced or natural means to the fuel cell power system's (3.49) enclosure.
- Water treatment system – System that provides all of the necessary treatment of the recovered or added water for use within the fuel cell power system (3.49).

For micro fuel cell power systems

- Fuel cartridge – Removable article that contains and supplies fuel to the micro fuel cell power unit (3.74) or internal reservoir, not to be refilled by the user. Possible variations include:
  - attached – having its own enclosure that connects to the device powered by the micro fuel cell power system (3.49.1);
  - exterior – having its own enclosure that forms a portion of the enclosure of the device powered by the micro fuel cell power system (3.49.1);
  - insert – having its own enclosure and is installed within the enclosure of the device powered by the micro fuel cell power system (3.49.1);
  - satellite – intended to be connected to and removed from the micro fuel cell power unit (3.74) to transfer fuel to the internal reservoir inside micro fuel cell power unit.
- Micro fuel cell power unit – Micro fuel cell power system (3.49.1) excluding its fuel cartridge

Other terms used in the diagrams, include the following.

- Discharge water – Water discharged from the fuel cell power system (3.49) including wastewater and condensate.

- EMD (electromagnetic disturbance) – Any electromagnetic phenomenon that may degrade the performance of a device, equipment or system, or adversely affect living or inert matter. [IEC 60050-161:1990, 161-01-05]
- EMI (electromagnetic interference) – Degradation of the performance of an equipment, transmission channel or system caused by an electromagnetic disturbance. [IEC 60050-161:1990, 161-01-06]
- Recovered heat – Thermal energy that has been recovered for useful purposes.
- Waste heat – Thermal energy released and not recovered.

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
air bleed
introduction of small levels of air (around 5 %) into the fuel stream, upstream of the fuel inlet to the fuel cell (3.43) or fuel cell stack (3.50) or within the anode (3.2) compartment

NOTE The purpose of air bleed is to mitigate poisoning by species such as carbon monoxide by catalytic oxidation of the poison within the anode (3.2) compartment of the fuel cell (3.43).

3.2
anode
electrode (3.33) at which the oxidation of the fuel takes place

[IEC 60050-482:2004, 482-02-27, modified]

3.3
active layer
See catalyst layer (3.14).

3.4
area

3.4.1
cell area
geometric area of the bipolar plate (3.9) perpendicular to the direction of current flow

NOTE The cell area is expressed in m^2.

3.4.2
electrode area

3.4.2.1
active area
geometric area of the electrode (3.33) perpendicular to the direction of the current flow

NOTE 1 The active area is expressed in m^2.

NOTE 2 The active area, also called effective area is used in the calculation of the cell current density (3.26).

3.4.2.2
effective area
See active area (3.4.2.1).

3.4.2.3
electrochemical surface area
area of the electrochemically accessible electrocatalyst (3.31) surface

NOTE The electrochemical surface area is expressed in m^2.

3.4.3
membrane electrode assembly (MEA) area
geometric area of the entire MEA (3.73) perpendicular to the direction of net current flow, including active area (3.4.2.1), and uncatalysed areas of the membrane

NOTE The membrane electrode assembly (MEA) area is expressed in m^2.

3.4.4
specific surface area
area of an electrocatalyst (3.31) accessible to reactants due to its open porous structure or electrochemical surface area (3.4.2.3) per unit mass (or volume) of the catalyst (3.11)

NOTE The specific surface area is expressed in m^2/g, m^2/m^3.

3.5
availability factor
ratio of the up duration to the period of time under consideration

[IEC 60050-603:1986, 603-05-09]

3.6
axial load
compressive load applied to the end plates (3.40) of a fuel cell stack (3.50) to assure contact and/or gas tightness

NOTE The axial load is expressed in Pa.

3.7
balance of plant
BOP
supporting/auxiliary components based on the power source or site-specific requirements and integrated into a comprehensive power system package

NOTE In general, all components besides the fuel cell stack (3.50) or fuel cell module (3.48) and the fuel processing system are called balance of plant components.

3.8
base load operation
See full load operation (3.77.4).

3.9
bipolar plate
conductive plate separating individual cells in a stack, acting as current collector (3.25) and providing mechanical support for the electrodes (3.33) or membrane electrode assembly (3.73)

NOTE The bipolar plate usually incorporates flow field on either side for the distribution of reactants (fuel and oxidant) and removal of products, and may also contain conduits for heat transfer. The bipolar plate provides a physical barrier to avoid mixing of oxidant, fuel and coolant fluids. The bipolar plate is also known as the bipolar separating plate.

3.10
bus bar
See stack terminal (3.105).

3.11
catalyst
substance that accelerates (increases the rate of) a reaction without being consumed itself

See also electrocatalyst (3.31).

NOTE The catalyst lowers the activation energy of the reaction, allowing for an increase in the reaction rate.

3.12
catalyst coated membrane
CCM
(in a PEFC (3.43.6)) membrane whose surfaces are coated with a catalyst layer (3.14) to form the reaction zone of the electrode (3.33)

See also membrane electrode assembly (MEA) (3.73).

3.13
catalyst coated substrate
CCS
substrate whose surface is coated with a catalyst layer (3.14)

3.14
catalyst layer
surface adjacent to either side of the membrane containing the electrocatalyst (3.31), typically with ionic and electronic conductivity

NOTE The catalyst layer comprises the spatial region where the electrochemical reactions may take place.

3.15
catalyst loading
amount of catalyst (3.11) incorporated in the fuel cell (3.43) per unit active area (3.4.2.1), specified either per anode (3.2) or cathode (3.18) separately, or combined anode and cathode loading

NOTE The catalyst loading is expressed in g/m^2.

3.16
catalyst poisoning
inhibition of the catalyst (3.11) properties by substances (poisons)

NOTE Electrocatalyst (3.31) poisoning causes degradation of the fuel cell (3.43) performance.

3.17
catalyst sintering
binding together of catalyst (3.11) particles due to chemical and/or physical processes

3.18
cathode
electrode (3.33) at which the reduction of the oxidant takes place

[IEC 60050-482:2004, 482-02-28, modified]

3.19
cell(s)

3.19.1
planar cell
fuel cell (3.43) formed in a flat structure

3.19.2
single cell
basic unit of a fuel cell (3.43) consisting of a set of an anode (3.2) and a cathode (3.18) separated by electrolyte (3.34)

3.19.3
tubular cell
fuel cells (3.43) with a cylindrical structure that allows fuel and oxidant to flow on the inner or outer surface of the tube

NOTE Different cross section types can be used (e.g. circular, ellipse).

3.20
compression end plate
See end plate (3.40).

3.21
conditioning
(related to cells/stacks) preliminary step that is required to properly operate a fuel cell (3.43) and that is realized following a protocol specified by the manufacturer

NOTE The conditioning may include reversible and/or irreversible processes depending on the cell technology.

3.22
cross leakage
See crossover (3.23).

3.23
crossover
leakage between the fuel side and the oxidant side, of a fuel cell (3.43), in either direction, generally through the electrolyte (3.34)

NOTE Crossover is also called cross leakage.

3.24
current

3.24.1
leakage current
electric current in an unwanted conductive path other than a short-circuit

NOTE The leakage current is expressed in A.

[IEC 60050-151:2001, 151-15-49]

3.24.2
rated current
maximum continuous electric current as specified by the manufacturer, at which the fuel cell power system (3.49) has been designed to operate

NOTE The rated current is expressed in A.

3.25
current collector
conductive material in a fuel cell (3.43) that collects electrons from the anode (3.2) side or conducts electrons to the cathode (3.18) side

3.26
current density
current per unit active area (3.4.2.1)

NOTE The current density is expressed in A/m^2 or A/cm^2.

3.27
degradation rate
rate at which a cell's performance deteriorates over time

NOTE The degradation rate can be used to measure both recoverable and permanent losses in cell performance. The typical unit of measure is volts (DC) per unit time or % of initial value (volt DC) per a fixed time.

3.28
desulfurizer
reactor to remove sulfur components contained in raw fuel (3.89)

NOTE Adsorbent desulfurizer, catalytic hydro-desulfurizer, etc.

3.29
differential cell pressure
difference in pressure across the electrolyte (3.34) as measured from one electrode (3.33) to the other

NOTE The differential cell pressure is expressed in Pa.

3.30
efficiency
ratio of output useful energy flows to input energy flows of a device

NOTE The energy flows can be measured by measuring the relevant in and output values over one single defined time interval, and can, therefore, be understood as mean value of the respective flows.

3.30.1
electrical efficiency
ratio of the net electrical power (3.85.3) produced by a fuel cell power system (3.49) to the total enthalpy flow supplied to the fuel cell power system

NOTE Lower heating value (LHV) is assumed unless otherwise stated.

3.30.2
exergetic efficiency
ratio of the net electrical power (3.85.3) produced by a fuel cell power system (3.49) and the total exergy flow supplied to the fuel cell system assuming gaseous reaction products

3.30.3
heat recovery efficiency
ratio of recovered heat flow of a fuel cell power system (3.49) and the total enthalpy flow supplied to the fuel cell power system

NOTE The supplied total (including reaction enthalpy) enthalpy flow of the raw fuel (3.89) should be related to lower heating value (LHV) for a better comparison with other types of energy conversion systems.

3.30.4
overall energy or total thermal efficiency
ratio of total useable energy flow (net electrical power (3.85.3) and recovered heat flow) to the total enthalpy flow supplied to the fuel cell power system (3.49)

NOTE The supplied total (including reaction enthalpy) enthalpy flow of the raw fuel (3.89) should be related to lower heating value (LHV) for a better comparison with other types of energy conversion systems.

3.30.5
overall exergy efficiency
ratio of the sum of net electrical power (3.85.3) and total useable exergy flow of recovered heat related to the total exergy flow supplied to the fuel cell power system (3.49)

NOTE The supplied total exergy flow of the raw fuel (3.89) (including reaction) should be related to a gaseous product for a better comparison with other types of energy conversion systems.

3.31
electrocatalyst
substance that accelerates (increases the rate of) an electrochemical reaction

See also catalyst (3.11).

NOTE In a fuel cell (3.43), electrocatalysts are placed in the active (3.3) or catalyst layer (3.14).

3.32
electrocatalyst support
component of an electrode (3.33) that is the support of the electrocatalyst (3.31), and serves as the conductive medium

3.33
electrode
an electronic conductor (or semi-conductor) through which an electric current enters or leaves the electrochemical cell as the result of an electrochemical reaction

NOTE An electrode (3.33) may be either an anode (3.2) or cathode (3.18).

3.33.1
gas diffusion electrode
component on the anode (3.2) or cathode (3.18) side comprising all electronic conductive elements of the electrode (3.33), i.e. gas diffusion layer (3.57) and catalyst layer (3.14)