

## H01M

### Processes or means, e.g. batteries for the direct conversion of chemical into electrical energy

#### Definition statement

*This subclass/group covers:*

Casing, racks, vents, current conducting connections of primary (non rechargeable) and secondary (rechargeable) batteries

Electrodes for primary and secondary battery

Electrodes for fuel cells

Primary cells, secondary cells, their methods for maintenance and the recycling of serviceable parts of waste cells

Fuel cells, e.g. alkaline fuel cell, polymer electrolyte fuel cell (PEMFC), solid oxide fuel cell (SOFC), molten carbonate fuel cell (MCFC), biochemical fuel cells

Reverse electrodialysis cells

Redox flow batteries

#### Relationship between large subject matter areas

Electrochemical processes or apparatus otherwise than for generating energy  
C25

#### Informative references

*Attention is drawn to the following places, which may be of interest for search:*

Electrochemical processes or apparatus otherwise than for generating energy	C25
Semiconductor or other solid state devices for converting light or heat into electrical energy	<a href="#">H01L</a> , <a href="#">H01L 31/00</a> , <a href="#">H01L 35/00</a> , <a href="#">H01L 37/00</a>

#### Special rules of classification within this subclass

Every aspect of the invention is classified in the groups and the additional information is classified mandatorily with Indexing Codes.

When an Indexing Code represents the invention with no corresponding mirror group, the corresponding upper group should also be given.

When the type of battery is not mentioned, the classification of the invention is done in the primary and secondary type of battery classes.

When a group for a process does not exist, it is classified within the material of the object.

Additional orthogonal Indexing Codes are used for "additional information" and are always given together with a CPC group. Classification with these codes is highly desirable, since they provide an efficient search tool when combined with a CPC group.

They concern:

[H01M 2200/00](#) and subgroups : Safety devices for primary or secondary batteries

[H01M 2220/00](#) and subgroups : Batteries for particular applications

[H01M 2250/00](#) and subgroups : Fuel cells for particular applications; Specific features of fuel cell system

[H01M 2300/00](#) and subgroups : Electrolytes

## **H01M 2/00**

### **Constructional details or processes of manufacture of the non-active parts of batteries and hybrids cells**

#### **Definition statement**

*This subclass/group covers:*

- Cases, jackets or wrappings, lids or covers, carrying devices, racks, fixing devices;
- Vents plugs, mechanical arrangement for the escape of gas
- Separators, diaphragms, spacing elements;
- Current conducting connections for cells, terminals, connections for affording protection against corrosion, for preventing undesired use;
- Arrangements for filling, emptying cases with or of liquid e.g. Electrolytes, moving electrolytes.

#### **References relevant to classification in this subgroup**

*This subclass/group does not cover:*

Constructional details or processes of manufacture of the non-active parts of fuel cells	<a href="#">H01M 8/00</a>
Electrically conductive connectors connecting the battery to the load, electric system	<a href="#">H01R</a>

## Informative references

*Attention is drawn to the following places, which may be of interest for search:*

Electrotherapy, e.g. implantable medical devices	<a href="#">A61N</a>
Separation using semi-permeable membrane	<a href="#">B01D 61/00</a> - <a href="#">B01D 71/00</a>
Drill tools	<a href="#">B23B 51/00</a>
Portable power-driven tools	<a href="#">B25F</a>
Shaping or joining plastics	<a href="#">B29C 43/00</a>
Container for storage	<a href="#">B65D</a>
Devices for moving or tilting heavy load, load-carrier	<a href="#">B65G 7/12</a>
Making textile fabrics from fibers	<a href="#">D04H</a>
Sealing	<a href="#">F16J 15/00</a>
Valves	<a href="#">F16K</a>

## Special rules of classification within this subgroup

Small-sized batteries indicate batteries used in portable devices

Large-sized batteries indicate batteries used in vehicles or standby power.

When the use of a battery can not be deduce, the classification is done in both classes.

[H01M 2/02](#) relates to the first wall around the active parts and [H01M 2/10](#) relates to the second wall around the battery/cell.

When the material of separator is a mixture of fibrous and non-fibrous material, it's classified in the classes of the fibrous material.

## H01M 4/00

### Electrodes (electrodes for electrolytic processes)

#### Definition statement

*This subclass/group covers:*

Electrodes comprising active material for primary, secondary and hybrid cell and electrodes with catalytic activity for fuel cells.

Processes of manufacture of the electrodes, selection of substances as active materials, carriers or collectors, inactive substances as ingredients in the electrode, e.g. binder, conductive material

#### Relationship between large subject matter areas

The production of active material used in batteries is not classified in [H01M](#) but in [C01B](#), [C01D](#), [C01F](#), [C01G](#), [C22C](#), [C04B 35/00](#)

#### Informative references

*Attention is drawn to the following places, which may be of interest for search:*

General process for applying liquids to obtain a coating with specific electrical properties	<a href="#">B05D 5/12</a>
Processing of sheet metal	<a href="#">B21D</a>
Casting of metals	<a href="#">B22D</a>
Working metallic powder	<a href="#">B22F</a>
Soldering, welding	<a href="#">B23K</a>
Layered products	<a href="#">B32B</a>
Nano-structures	<a href="#">B82B</a>
Carbon	<a href="#">C01B 31/00</a>
Compounds of alkali metals	<a href="#">C01D</a>

Compounds of Be, Mg, Al, Ca, Sr, Ba, Ra, Th or rare earth metals	<a href="#">C01F</a>
Compounds of manganese	<a href="#">C01G 45/00</a>
Compounds of Nickel	<a href="#">C01G 53/00</a>
Alloys	<a href="#">C22C</a>
Shaped ceramic products	<a href="#">C04B 35/00</a>
Organic macromolecular compounds	<a href="#">C08G</a> , <a href="#">C08L</a>
Coating metallic material, surface treatment of metallic material, e.g. vacuum evaporation	<a href="#">C23C</a> , <a href="#">C23C 14/00</a>
Electrolytic or electrophoretic processes for the production of compounds or non-metals, electrodes for those process	<a href="#">C25B</a>
Carbon filaments	<a href="#">D01F 9/12</a>
Conductors characterised by the conductive materials	<a href="#">H01B 1/12</a>
Magnetic materials	<a href="#">H01F</a>

### Special rules of classification within this subgroup

The IPC rule concerning electrode for hybrid cells is applied

Classification of electrode versus classification of active material ([H01M 4/38-H01M 4/60](#)) should only be given when the invention concern the combination of active material and non-active materials, information given on the different elements constituting the electrode.

[H01M 4/02](#) is only employed if the subject to be classified is general and does not concern the subgroups [H01M 4/06](#), [H01M 4/13](#), [H01M 4/14](#), [H01M 4/24](#)

The process of manufacture of a specific type of battery electrode is classified in [H01M 4/16-H01M 4/23](#) or [H01M 4/26-H01M 4/30](#) or [H01M 4/139-H01M 4/1399](#) and in [H01M 4/04-H01M4/04V4](#) (double classification).

[H01M 4/02](#) and [H01M 4/04-H01M4/04V4](#) should not be used for fuel cell

electrodes and their manufacture which are classified in [H01M 4/86-H01M 4/8896](#)

All the steps of the process of the manufacture of an electrode (battery electrode or fuel cell electrode) should be classified if possible.

When oxides are added in an electrode and when it's not sure whether it's an active material or an additive, classes in [H01M 4/48-H01M 4/57](#), [H01M 4/62](#) and [H01M 4/362](#) should be given

[H01M 4/366](#) is used for any coating (the coating being a second active material or not). In the case the coating is not a second active material, [H01M 4/62](#) subgroup should be given.

[H01M 4/364](#) is only used for mixture of at least 2 active materials.

Classification of alloys under [H01M 4/38](#) relate to the composition before charging, e.g. before the addition of lithium.

Electroactive polymers classified in [H01M 4/137](#) concern polymers where oxidation/reduction (redox) processes take place

Electrode composed of Lithium or lithium based alloy is classified in [H01M 4/134](#)

[H01M 4/18](#) relates to Planté electrode process. It concerns lead dioxide generated by direct oxydation of lead that forms the conducting substrate.

Alkaline earth metals oxides or hydroxides, oxides or hydroxides of metal other than manganese, nickel, iron, cobalt, silver, lead, mercury are classified in [H01M 4/48](#) and if they insert or intercalate light metals, they are classified in [H01M 4/485](#).

## **H01M 4/86**

### **Inert Electrodes with catalytic activity, e.g. for fuel cells**

#### **Definition statement**

*This subclass/group covers:*

Electrodes for fuel cells, comprising catalysts

#### **Informative references**

*Attention is drawn to the following places, which may be of interest for search:*

Catalysts	<a href="#">B01J</a> , <a href="#">B01J 23/38</a>
Process for preparing catalyst	<a href="#">B01J 37/00</a>

## Special rules of classification within this subgroup

Catalysts supported on carbon are not classified in [H01M 4/96](#) but in [H01M 4/9083](#) or [H01M 4/926](#).

[H01M 4/96](#) is only given if carbon is the catalytic species, e.g. for hybrid cells.

[H01M 4/8647](#)-[H01M 4/8657](#) concern composite material, meaning comprising at least 2 catalysts having the same function and [H01M 4/8615](#) concerns bifunctional electrode used in regenerative fuel cell with oxygen reduction catalyst and oxygen evolution reaction catalyst.

All the steps of the process of the manufacture of a fuel cell electrode should be classified if possible within subgroups [H01M 4/88](#)-[H01M 4/8896](#)

The process for making electrocatalyst are classified within the catalyst material subgroups [H01M 4/90](#)-[H01M 4/923](#). Catalysts used only in fuel cells are not classified in [B01J](#).

## H01M 6/00

### Primary batteries; Manufacture thereof

#### Definition statement

*This subclass/group covers:*

Primary batteries with aqueous electrolyte, non-aqueous electrolyte and solid electrolyte.

primary batteries activated by addition of electrolyte, by physical means (thermal and mechanical)

thin film or flat or printed primary batteries

Methods or arrangements for maintenance of primary batteries including heating or cooling, primary batteries combined with cell condition or safety devices, regeneration of reactants or electrolyte, type recognition

#### Informative references

*Attention is drawn to the following places, which may be of interest for search:*

Thermoelectric solid state devices	<a href="#">H01L 35/00</a>
------------------------------------	----------------------------

## Special rules of classification within this subgroup

Classification for primary and secondary non aqueous batteries:

When it concerns only primary battery : [H01M 6/162-H01M 6/188](#)

When it concerns primary and secondary battery or in case of doubt : both subgroups are given : [H01M 6/162-H01M 6/188](#) and [H01M 10/056-H01M 10/0569](#)

When it concerns only secondary battery : [H01M 10/056-H01M 10/0569](#)

Solid polymer electrolyte of a battery is not classified in [H01M 8/1018](#) unless the use in a fuel cell is mentioned.

Printed battery in [H01M 6/40](#) concern thin film battery.

## Glossary of terms

*In this subclass/group, the following terms (or expressions) are used with the meaning indicated:*

Primary cells	Electrochemical generators in which the cell energy is present in chemical form and is not regenerated
---------------	--

## H01M 8/00

### Fuel cells; Manufacture thereof

#### Definition statement

*This subclass/group covers:*

Fuel cells including:

- Collectors, separators, interconnectors, gas diffusion layer.
- Sealing or frames, its processes and materials.
- Membranes, matrices holding electrolytes solutions or melts.
- Means for temperature measurement or control, for reactant control or regulation.
- Methods for controlling fuel cells or fuel cell systems with detection and regulation of variables .
- System of fuel cells with means for production of reactants or for treatment of residues.
- Types of fuel cell : with aqueous electrolytes, with solid electrolyte at low temperature (below 200-250°C), with solid electrolyte at high temperature. with molten electrolyte, biofuelcells with enzymes working

as catalysts.

- Manufacture of fuel cells.

## Relationship between large subject matter areas

Hydrogen production is classified in [C01B 3/00](#)

## Informative references

*Attention is drawn to the following places, which may be of interest for search:*

Separation of gases or vapour	<a href="#">B01D 53/00</a>
Semi-permeable membranes	<a href="#">B01D 67/00</a> , <a href="#">B01D 69/00</a> , <a href="#">B01D 71/00</a>
Recycling of heat from fuel cell to other parts of a car	<a href="#">B60H 1/00278</a>
Fuel cells used to drive air conditioning	<a href="#">B60H 1/00428</a>
Prime movers consisting of electric motors and internal combustion engines characterised by the fuel cells	<a href="#">B60K 6/32</a>
Vehicles using power supplied from primary cells, secondary cells or fuel cells	<a href="#">B60L 11/18</a>
Arrangement or adaptations of fuel cells in cosmonautic vehicles	<a href="#">B64G 1/423</a>
Manufacture of ion-exchange membrane	<a href="#">C08J 5/22</a>
Production of combustible gases containing carbon monoxide from solid carbonaceous fuels	<a href="#">C10J 3/00</a>
Liquid carbonaceous fuels	<a href="#">C10L 1/00</a>
Micro-organisms or enzymes	<a href="#">C12N</a>
Enzyme electrodes in measuring or testing process	<a href="#">C12Q 1/001</a>

Vessels for containing or storing compressed, liquefied or solidified gases	<a href="#">F17C</a>
Burners for combustion of a gas	<a href="#">F23D 14/00</a>
Gas-turbine combustion chambers	<a href="#">F23R</a>

### Special rules of classification within this group

Membranes for immobilising electrolyte solutions or electrolyte melts are classified in [H01M 8/0289-H01M 8/0295](#) and membranes used as support or mixed with polymer electrolytes are classified in [H01M 8/1058-H01M 8/1062](#).

Means for control of temperature, pressure, reactant, electrolyte, water are classified in subgroups [H01M 8/04007-H01M 8/04291](#) and methods for controlling fuel cells or fuel cell systems are classified in [H01M 8/04298-H01M 8/04992](#).

Reactant in a fuel cell is only what is delivery immediately to the fuel cell , e.g. liquid methanol is evaporated to gaseous methanol that is used then in a fuel cell, only [H01M 8/04089](#) will be used.

Means for preventing methanol crossover (gaseous or liquid methanol) are classified in [H01M 8/04261](#)

[H01M 8/04119](#) concerns the humidification in the fuel cell

[H01M 8/04291](#) is used for water management of the fuel cell system.

Rules for [H01M 8/04298](#)

When the claims refer to control and/or process/management of the fuel cell, then classes in [H01M 8/04298+](#) should be given and it's the description + claims (if they are clear) that are classified. Every variable really disclosed/discussed and not just listed as part of a whole list should be classified using classes.

If only general details is given in the detected and/or regulated variables, then the upper classes [H01M 8/04313](#) and/or [H01M 8/04694](#) should be given.

When control/management is detailed only in the description, then Indexing Codes should be used for the classification

When the control of a fuel cell concerns the detection/measurement of environmental variables (e.g. temperature, pressure, humidity of the ambience), the classes [H01M 8/0432](#) should be given if it concerns the detection of ambient temperature or [H01M 8/0438](#) if it concerns ambient pressure, etc..

In a system with means for production of reactants or treatment of reactants or residues, if the fuel cell aspect is not the invention (only mentioned in the description or the last (sub)claim, the document should only be classified with an Indexing Code [H01M 8/00](#).

If the fuel cell in combination with the other means is the invention, then the subgroups under [H01M 8/06](#) are used.

[H01M 8/188](#) and [H01M 8/20](#) should be both allocated for redox flow battery

[H01M 8/24](#) subgroups are used when the invention concern the stack of fuel cells as such

The Indexing Codes [H01M 8/083](#), [H01M 8/086](#), [H01M 2008/1095](#), [H01M 2008/1293](#), [H01M 2008/147](#) should be used to indicate the type of fuel cell

## Glossary of terms

*In this subclass/group, the following terms (or expressions) are used with the meaning indicated:*

In the patent document the following terms are used with the meaning indicated:

Porous separator	gas diffusion layer
Separator	bipolar plate, interconnector

## H01M 10/00

### Secondary cells; Manufacture thereof

#### Definition statement

*This subclass/group covers:*

Construction in general.

Several types of secondary batteries : lithium batteries, lead acid batteries, alkaline batteries, high temperature batteries.

Methods or arrangements for servicing or maintenance.

Cooling, heating, regulating temperature.

Recycling.

#### Relationship between large subject matter areas

Circuits for charging or depolarising or for supplying loads from batteries are classified in [H02J 7/00-H02J 7/36](#) and the methods for charging or discharging are classified in [H01M 10/44-H01M 10/445](#).

Measuring electric variables are classified in [G01R 31/36](#) if the measurement device is not structurally combined with the battery

Air conditioner of a car classified in [B60H](#) is also classified under [H01M 10/50-H01M 10/5097](#) if it's used for cooling/heating a battery.

## Informative references

*Attention is drawn to the following places, which may be of interest for search:*

Heating, cooling or ventilation devices in vehicles	<a href="#">B60H</a> , <a href="#">B60H 1/00278</a>
Arrangement of electric storage means for propulsion	<a href="#">B60K 1/04</a>
Prime movers consisting if electric motors and internal combustion engines	<a href="#">B60K 6/28</a> ,
Vehicles using power form primary cells, secondary cells or fuel cells	<a href="#">B60L 11/18</a>
Arrangement of batteries in a vehicle	<a href="#">B60R 16/04</a>
Supplying batteries to, or removing batteries from vehicles	<a href="#">B60S 5/06</a>
Specific uses or applications of nano-structures	<a href="#">B82Y</a>
Electrochemical actuator	<a href="#">F03G 7/005</a>
Heat exchange or heat transfer apparatus	<a href="#">F28B</a> , <a href="#">F28C</a> , <a href="#">F28D</a> , <a href="#">F28F</a>
Control of temperature in general	<a href="#">G05D 23/00</a>
Indicating or measuring liquid in general	<a href="#">G01F 23/00</a>
Arrangement for obtaining electrical energy form radioactive source	<a href="#">G21H 1/04</a>

Investigating fluid tightness of structure	<a href="#">G01M 3/00</a>
Measuring density	<a href="#">G01N 9/00</a>
Investigating or analysing materials by the use of electric, electrochemical or magnetic means	<a href="#">G01N 27/26</a>
Semi-conductors devices	<a href="#">H01L</a>
Generators in which kinetic energy is converted into electrical energy	<a href="#">H02N 3/00</a>
Portable receivers and arrangement for mounting batteries or batteries chargers	<a href="#">H04B 1/3883</a>
Portable phone with battery compartment	<a href="#">H04M 1/0262</a>
Printed circuits	<a href="#">H05K</a>

### Special rules of classification within this subgroup

- Small-sized batteries indicate batteries used in portable devices
- Large-sized batteries indicate batteries used in vehicles or standby power.
- Construction classes under [H01M 10/12](#), [H01M 10/28](#), [H01M 10/058](#), [H01M 10/38](#) take precedence over [H01M 10/04](#).
- For non aqueous secondary battery, a class indicating the type of battery, e.g. [H01M 10/052](#) should always be given in addition to the classes related to construction [H01M 10/058-H01M 10/0587](#) or to the classes related to the type of electrolyte [H01M 10/056-H01M10/0659](#).
- Solid polymer electrolyte of a battery is not classified in [H01M 8/1018-H01M 8/1093](#) unless the use of this polymer in a fuel cell is indicated.
- Special rules for the subgroups [H01M 10/42-H01M 10/488](#)
- Additives in electrolyte having the function of safety are classified in [H01M 01/0567](#) for example and also in [H01M 10/4235](#). Fusing,

polymerising additives are also classified in [H01M 10/4235](#).

- Structurally combination indicates attached to the battery or in the battery housing.
- Printed circuits integrated to the outside of the casing of the battery, e.g. on the cover) are classified in [H01M 10/425](#)
- [H01M 10/4257](#) concern battery with incorporated memory, microchip, electronic circuit inside the housing of the cells or batteries.
- The use of printed circuit as a casing of a battery is classified in [H01M 2/10](#).
- Apparatus for testing the cell or battery and not incorporated with the battery is classified in [H01M 10/4285](#)
- The regeneration of electrolyte or reactants done by non electrical means is classified in [H01M 10/4242](#)
- Any ratio between electrode/electrolyte, anode/cathode of a secondary battery is classified in [H01M 2010/4292](#)
- Removing gas inside the battery by water recombination is classified in [H01M 10/52](#).
- Gel electrolytes are double classified in [H01M 10/0565](#) if they concern gel-type polymeric material for non-aqueous accumulator and
- [H01M 2300/0085](#)

## Glossary of terms

*In this subclass/group, the following terms (or expressions) are used with the meaning indicated:*

Accumulator	secondary battery
Secondary cells	Accumulators receiving and supplying electrical energy by means of reversible electrochemical reactions

## H01M 12/00

### Hybrid cells and manufacture thereof

#### Definition statement

*This subclass/group covers:*

hybrid cells, e.g. :

- half cell of capacitor type and half-cell of primary or secondary battery type
- half cell of fuel cell type and half cell of primary or secondary cell type

## Relationship between large subject matter areas

Hybrid capacitors are classified in [H01G 9/155](#)

## Special rules of classification within this group

- If the invention concern electrodes, classes of fuel cell electrodes ([H01M 4/86-H01M 4/98](#)) and/or battery electrodes ([H01M 4/02-H01M 4/84](#)) are given in combination with the Indexing Code of the hybrid cells.
- The casing and the lid of the hybrid cells are classified in [H01M 2/0255](#) and [H01M 2/0452](#) respectively.
- Methods or arrangements for servicing or maintenance are classified in [H01M 6/50](#) or [H01M 10/42](#) according to the type of half battery cell. The control of half fuel cell type is classified under [H01M 8/04298-H01M 8/04992](#).
- All hybrid cell concerning half capacitor, half battery should be circulated to [H01G](#).

## Glossary of terms

*In this subclass/group, the following terms (or expressions) are used with the meaning indicated:*

Hybrid cells	Electrochemical generators having two different types of half-cells, the half-cell being an electrode-electrolyte combination of either a primary, a secondary, or a fuel cell
--------------	--

## H01M 14/00

**Electrochemical current or voltage generators not provided for in groups [H01M 6/00](#)- [H01M 12/00](#) ; Manufacture thereof**

## Definition statement

*This subclass/group covers:*

Every type of electrochemical cell that is not classified in the above groups.

Photoelectrochemical storage cells wherein the light causes a change in chemistry and the energy is stored and discharged at later stage.

### **Relationship between large subject matter areas**

Solar cells are classified in [H01G 9/20](#) and only if the energy produced by the solar cell is stored then it will be also classified in [H01M 14/005](#).

### **References relevant to classification in this subgroup**

*This subclass/group does not cover:*

Light sensitive devices (photocells)	<a href="#">H01G 9/20</a>
--------------------------------------	---------------------------

### **Synonyms and Keywords**

*In patent documents the following expressions/words " photocells ", "photoelectrochemical cells (PEC)", " photovoltaic cells" and "solar cells" are often used as synonyms.*

## **H01M 16/00**

### **Structural combinations of different types of electrochemical generators**

#### **Definition statement**

*This subclass/group covers:*

Association of fuel cells with other electrochemical generators, e.g. fuel cell + electrolyzers, fuel cell+ battery, fuel cell + capacitor

### **References relevant to classification in this subgroup**

*This subclass/group does not cover:*

Combination of secondary battery with capacitor	<a href="#">H01M 10/4264</a>
---	------------------------------