

**CPC****COOPERATIVE PATENT CLASSIFICATION****H01M****PROCESSES OR MEANS, e.g. BATTERIES, FOR THE DIRECT CONVERSION OF CHEMICAL INTO ELECTRICAL ENERGY**

(electrochemical processes or apparatus in general [C25](#); semiconductor or other solid state devices for converting light or heat into electrical energy [H01L](#), e.g. [H01L 31/00](#), [H01L 35/00](#), [H01L 37/00](#))

**NOTE**

This subclass covers galvanic primary or secondary cells or batteries, fuel cells or batteries.

**H01M 2/00****Constructional details or processes of manufacture of the non-active parts****H01M 2/02**

- Cases, jackets or wrappings ([working of plastics or substances in plastic state B29](#))

**H01M 2/0202**

- • {for small-sized cells or batteries, e.g. miniature battery or power cells, batteries or cells for portable equipment ([H01M 2/025](#) takes precedence)}

**H01M 2002/0205**

- • • {Cases with a shape not covered by groups [H01M 2/0207](#) - [H01M 2/0235](#)}

**H01M 2/0207**

- • • {Flat-shaped cells or batteries of flat cells ([H01M 2/0222](#) takes precedence)}

**H01M 2/021**

- • • • {with both terminals passing through the case or cover}

**H01M 2/0212**

- • • • {with plate-like or sheet-like terminals ([H01M 2/0215](#) takes precedence)}

**H01M 2/0215**

- • • • {with window-shaped terminals}

**H01M 2/0217**

- • • {Cases of prismatic shape}

**H01M 2/022**

- • • {Cases of cylindrical or round shape}

**H01M 2/0222**

- • • • {Button or coin cell cases}

**H01M 2/0225**

- • • • {with cup-shaped terminals}

**H01M 2/0227**

- • • • • {with both cup-shaped terminals}

**H01M 2/023**

- • • • • {with one cup-shaped terminal}

**H01M 2/0232**

- • • • • {with a passing-through terminal ([H01M 2/0235](#) takes precedence)}

**H01M 2/0235**

- • • • • {with a collector centrally disposed in the active mass, e.g. Leclanch cells}

**H01M 2/0237**

- • {for large-sized cells or batteries, e.g. L.I.S. batteries, traction or motive power type or standby power batteries ([H01M 2/025](#) takes precedence)}

**H01M 2/024**

- • • {Details}

**H01M 2/0242**

- • • {Monobloc manufactured cases comprising multiple compartments}

**H01M 2/0245**

- • • {Assembly of different cases, i.e. modular battery or cases particularly provided with means for assembling}

**H01M 2/0247**

- • • • {sealed to each other in a non-detachable manner}

- H01M 2/025 . . {for cells or batteries working under specific conditions such as high temperature, gas diffusion, external electrolyte circulation, external supply of reactants}
- H01M 2/0252 . . . {High- temperature cells or batteries, e.g. Na-S cells, Li-Cl<sub>2</sub> cells}
- H01M 2/0255 . . . {Hybrid cells or batteries ([H01M 2/0222](#) takes precedence)}
- H01M 2/0257 . . {characterised by the material}
- H01M 2/026 . . . {for small-sized cells or batteries, batteries or cells for portable equipment}
- H01M 2/0262 . . . {for large-sized cells or batteries, batteries or cells for traction or motive power or standby power}
- H01M 2/0265 . . . {for high-temperature cells}
- H01M 2/0267 . . . {of wrappings, outside coatings, jackets around completely closed cell elements}
- H01M 2/027 . . . {Casing material forming terminal of the cell}
- H01M 2/0272 . . . . {characterized by the internal coating or internal conductive layer}
- H01M 2/0275 . . . {of flexible envelopes or bags around open cell elements}
- H01M 2/0277 . . . {Insulating material ([H01M 2/029](#) takes precedence)}
- H01M 2/028 . . . . {being one layer}
- H01M 2/0282 . . . . . {having particulate or reinforced material}
- H01M 2/0285 . . . {Conductive material}
- H01M 2/0287 . . . {comprising layers}
- H01M 2/029 . . . . {consisting only of insulating material}
- H01M 2/0292 . . . . {characterised by the external coating on the casing}
- H01M 2/0295 . . . {Composite material consisting of mixed or dispersed phases}
- H01M 2002/0297 . . . {characterised by physical parameters}
- H01M 2/04 . . Lids or covers
- H01M 2/0404 . . . {for small-sized cells or batteries, e.g. miniature battery or power cells, batteries or cells for portable equipment ([H01M 2/0443](#) takes precedence)}
- H01M 2/0408 . . . . {Crimp-sealed cells or batteries; Cells or batteries with turned-over edges}
- H01M 2/0413 . . . . . {provided with an intermediary sealing member between the crimped or curled edges ([H01M 2/0417](#) takes precedence)}
- H01M 2/0417 . . . . . {comprising an insulating cover provided with an axial bore for receiving a central current collector}
- H01M 2/0421 . . . . . . {with an external conductive cover}
- H01M 2/0426 . . . . . {with a metallic cover of which the borders are soldered or welded with the case}
- H01M 2/043 . . . {for large-sized cells or batteries, e.g. LIS batteries, traction or motive power type or standby power batteries ([H01M 2/0443](#) takes precedence)}
- H01M 2/0434 . . . . {Methods for assembling case and cover}
- H01M 2/0439 . . . . . {without provisions for disassembling}

- H01M 2/0443 . . . {for cells or batteries working under specific conditions such as high temperature, gas diffusion, external electrolyte circulation, external supply of reactants}
- H01M 2/0447 . . . . {High-temperature cells or batteries}
- H01M 2/0452 . . . . {Hybrid cells or batteries}
- H01M 2/0456 . . . {characterised by the shape}
- H01M 2/046 . . . . {Disk-like lids for cylindrical batteries}
- H01M 2/0465 . . . . . {Button cell lids}
- H01M 2/0469 . . . . {Lids for flat or sheet-like batteries}
- H01M 2/0473 . . . . {Lids for prismatic cells}
- H01M 2/0478 . . . {characterised by the material}
- H01M 2/0482 . . . . {Insulating materials}
- H01M 2/0486 . . . . {Conducting materials}
- H01M 2/0491 . . . . {characterised by the coating}
- H01M 2/0495 . . . . . {Conductive coating material}
- H01M 2/06 . . Arrangements for introducing electric connectors into or through cases
- H01M 2/065 . . . {using glass or ceramic sealing material}
- H01M 2/08 . . Sealing materials
- H01M 2/10 . Mountings; Suspension devices; Shock absorbers; Transport or carrying devices; Holders ([structural combination of accumulators with charging apparatus H01M 10/46](#))
- H01M 2/1005 . . {Carrying devices}
- H01M 2/1011 . . . {using the terminals or connecting links}
- H01M 2/1016 . . {Cabinets, cases, fixing devices, adapters, racks or battery packs}
- H01M 2/1022 . . . {for miniature batteries or batteries for portable equipment ([batteries in portable systems H01M 2220/30](#))}
- H01M 2/1027 . . . . {with the possibility of incorporating batteries of different sizes}
- H01M 2/1033 . . . . . {providing adapters around the batteries}
- H01M 2/1038 . . . . {for button cells}
- H01M 2/1044 . . . . . {forming a whole with or incorporated in or fixed to the electronic appliance}
- H01M 2/105 . . . . {for cells of cylindrical configuration}
- H01M 2/1055 . . . . . {forming a whole with or incorporated in or fixed to the electronic appliance}
- H01M 2/1061 . . . . {for cells of prismatic configuration or for sheet-like batteries}
- H01M 2/1066 . . . . . {forming a whole with or incorporated in or fixed to the electronic appliance}
- H01M 2/1072 . . . {for starting, lighting or ignition batteries; Vehicle traction batteries; Stationary or load leading batteries ([batteries in stationary systems H01M 2220/10](#), [batteries in motive systems H01M 2220/20](#))}
- H01M 2/1077 . . . . {Racks, groups of several batteries ([H01M 2/1088 takes precedence](#))}
- H01M 2/1083 . . . . {Fixing on vehicles}
- H01M 2/1088 . . . . {for accumulators working at high temperature}

- H01M 2/1094 . . {Particular characteristics of materials used to isolate the battery from its environment, e.g. thermal insulation, corrosion resistance, pressure resistance, electrolyte leakage}
- H01M 2/12 . Vent plugs or other mechanical arrangements for facilitating escape of gases
- H01M 2/1205 . . {Vent arrangements incorporated in vent plugs or multiplug systems detachable from the battery or cell}
- H01M 2/1211 . . . {Multiplug systems or arrangements; Plurality of plugs surrounded by a common cover}
- H01M 2/1217 . . . . {in the shape of a one-piece member}
- H01M 2/1223 . . {Vent arrangements of resealable design ([H01M 2/1205](#), [H01M 2/1247-H01M 2/1294](#) take precedence)}
- H01M 2/1229 . . . {comprising a deformable, elastic or flexible valve member}
- H01M 2/1235 . . {Emergency or safety arrangements of non-resealable design ([H01M 2/1205](#), [H01M 2/1247-H01M 2/1294](#) take precedence)}
- H01M 2/1241 . . . {in the form of rupturable membranes or weakened parts, e.g. pierced with the aid of a sharp member}
- H01M 2/1247 . . {Explosion- or splash-preventing means contained in the head space of the battery, e.g. means floating on the electrolyte}
- H01M 2/1252 . . {comprising elongated, tortuous or labyrinth-shaped exhaust passages in the battery cover or case; Double cover vent systems}
- H01M 2/1258 . . {containing electrolyte neutralising or absorbing means}
- H01M 2/1264 . . {comprising gas-pervious parts or elements}
- H01M 2/127 . . . {as flame arrester or ignition preventing means}
- H01M 2/1276 . . {Spring-loaded vent valves}
- H01M 2/1282 . . {Thermally responsive or sensitive vent means}
- H01M 2/1288 . . {Film- or sheet-like elastic valve members optionally coated with non-drying glue}
- H01M 2/1294 . . {Slit, perforated or punctured elastic valve members}
- H01M 2/14 . Separators; Membranes; Diaphragms; Spacing elements
- H01M 2/145 . . {Manufacturing processes}
- H01M 2/16 . . characterised by the material
- H01M 2/1606 . . . {comprising fibrous material}
- H01M 2/1613 . . . . {Inorganic fibrous material}
- H01M 2/162 . . . . {Organic fibrous material}
- H01M 2/1626 . . . . . {Natural fibres, e.g. cotton, cellulose}
- H01M 2/1633 . . . . {Mixtures of inorganic and organic fibres}
- H01M 2/164 . . . {comprising non-fibrous material ([H01M 2/1606](#) takes precedence)}
- H01M 2/1646 . . . . {Inorganic non-fibrous material}
- H01M 2/1653 . . . . {Organic non-fibrous material}
- H01M 2/166 . . . . {Mixtures of inorganic and organic non-fibrous material}
- H01M 2/1666 . . . {comprising a non-fibrous layer and a fibrous layer superimposed on one another}
- H01M 2/1673 . . . {Electrode-separator combination}

- H01M 2/168 . . . . {with adhesive layers between electrodes and separators}
- H01M 2/1686 . . . {Separators having two or more layers of either fibrous or non-fibrous materials}
- H01M 2/1693 . . . {Wood}
- H01M 2/18 . . characterised by the shape
- H01M 2/185 . . . {Separators made of one single microscopic fiber}
- H01M 2/20 . Current conducting connections for cells
- H01M 2/202 . . {Interconnectors for or interconnection of the terminals of adjacent or distinct batteries or cells}
- H01M 2/204 . . . {of small-sized cells or batteries, e.g. miniature battery or power cells, batteries or cells for portable equipment}
- H01M 2/206 . . . {of large-sized cells or batteries, e.g. L.I.S. batteries, traction or motive power type or standby power batteries}
- H01M 2/208 . . . {for cells or batteries working under specific conditions such as high temperature, gas diffusion, external electrolyte circulation, external supply of reactants}
- H01M 2/22 . . Fixed connections, i.e. not intended for disconnection
- H01M 2/24 . . . Intercell connections through partitions, e.g. in a battery case
- H01M 2/26 . . . Electrode connections
- H01M 2/263 . . . . {Electrode connections overlying wounded or folded electrode stacks}
- H01M 2/266 . . . . {Interconnections of several platelike electrodes in parallel, e.g. electrode pole straps or bridges}
- H01M 2/28 . . . . for lead-acid accumulators
- H01M 2/30 . . Terminals
- H01M 2/302 . . . {Terminal post members on carbon electrodes; Machines or processes for applying said terminal post members, e.g. capping of carbon rods}
- H01M 2/305 . . . {Poles or terminals for L.I.S, traction or motive power type or standby power batteries}
- H01M 2/307 . . . . {the poles being connected and passing through hollow metallic terminals, e.g. terminal bushings}
- H01M 2/32 . . Methods or arrangements for affording protection against corrosion; Selection of materials therefor
- H01M 2/34 . . with provision for preventing undesired use or discharge, {e.g. complete cut of current (safety devices [H01M 2200/00](#))}
- H01M 2/341 . . . {Anti-theft provisions}
- H01M 2/342 . . . {Protection against polarity reversal}
- H01M 2/344 . . . {Guarantee labels or covers}
- H01M 2/345 . . . {in response to pressure}
- H01M 2/347 . . . {in response to shock}
- H01M 2/348 . . . {in response to temperature}
- H01M 2/36 . arrangements for filling, topping-up or emptying cases with or of liquid, e.g. for filling with electrolytes, for washing-out
- H01M 2/361 . . {Filling of small-sized cells or batteries, e.g. miniature battery or power cells, batteries or cells for portable equipment}

- H01M 2/362 . . {Filling or topping up of large-sized cells or batteries, e.g. L.I.S. batteries, traction or motive power type or standby power batteries}
- H01M 2/364 . . {Removing or drainage of electrolyte; Cleaning battery or cell cases}
- H01M 2/365 . . {means or methods for closing or sealing the liquid supply hole}
- H01M 2/367 . . {with means for preventing spilling of liquid or electrolyte , e.g. when the battery is tilted or turned over}
- H01M 2/368 . . . {by closing the vent passages with a valve}
- H01M 2/38 . Arrangements for moving electrolytes
- H01M 2/385 . . {Electrolyte stirring by action of gases on or in the electrolyte}
- H01M 2/40 . . with external circulating path ([H01M 8/04](#) takes precedence)

**H01M 4/00**

**Electrodes** (electrodes for electrolytic processes [C25](#), {electrodes for hybrid or electric double capacitor [H01G 11/22](#)})

- H01M 4/02 . Electrodes composed of or comprising active material
- H01M 2004/021 . . {Physical characteristics, e.g. porosity, surface area}
- H01M 2004/022 . . {Electrodes made of one single microscopic fiber}
- H01M 2004/023 . . {Gel electrode}
- H01M 2004/024 . . {Insertable electrodes}
- H01M 2004/025 . . {with shapes other than plane or cylindrical}
- H01M 2004/026 . . {characterised by the polarity}
- H01M 2004/027 . . . {Negative electrodes}
- H01M 2004/028 . . . {Positive electrodes}
- H01M 2004/029 . . . {Bipolar electrodes}
- H01M 4/04 . . Processes of manufacture in general
- H01M 4/0402 . . . {Methods of deposition of the material}
- H01M 4/0404 . . . . {by coating on electrode collectors}
- H01M 4/0407 . . . . {by coating on an electrolyte layer}
- H01M 4/0409 . . . . {by a doctor blade method, slip-casting or roller coating}
- H01M 4/0411 . . . . {by extrusion}
- H01M 4/0414 . . . . {by screen printing}
- H01M 4/0416 . . . . {involving impregnation with a solution, dispersion, paste or dry powder ([H01M 4/0438](#) takes precedence)}
- H01M 4/0419 . . . . {involving spraying}
- H01M 4/0421 . . . . {involving vapour deposition}
- H01M 4/0423 . . . . . {Physical vapour deposition}
- H01M 4/0426 . . . . . {Sputtering}
- H01M 4/0428 . . . . . {Chemical vapour deposition}
- H01M 4/043 . . . {involving compressing or compaction}
- H01M 4/0433 . . . . {Molding}
- H01M 4/0435 . . . . {Rolling or calendering}
- H01M 4/0438 . . . {by electrochemical processing (electroless electrochemical plating [C23C 18/54](#))}

- H01M 4/044 . . . . {Activating, forming or electrochemical attack of the supporting material}
- H01M 4/0442 . . . . . {Anodisation, Oxidation (electrolytic coating by anodisation [C25D 9/00](#))}
- H01M 4/0445 . . . . . {Forming after manufacture of the electrode, e.g. first charge, cycling}
- H01M 4/0447 . . . . . . {of complete cells or cells stacks}
- H01M 4/045 . . . . {Electrochemical coating; Electrochemical impregnation}
- H01M 4/0452 . . . . . {from solutions}
- H01M 4/0454 . . . . . {from melts}
- H01M 4/0457 . . . . . {from dispersions or suspensions; Electrophoresis}
- H01M 4/0459 . . . . {Electrochemical doping, intercalation, occlusion or alloying}
- H01M 4/0461 . . . . . {Electrochemical alloying}
- H01M 4/0464 . . . . {Electro organic synthesis}
- H01M 4/0466 . . . . . {Electrochemical polymerisation}
- H01M 4/0469 . . . . {Electroforming a self-supporting electrode; Electroforming of powdered electrode material}
- H01M 4/0471 . . . {involving thermal treatment, e.g. firing, sintering, backing particulate active material, thermal decomposition, pyrolysis}
- H01M 4/0473 . . . {Filling tube-or pockets type electrodes; Applying active mass in cup-shaped terminals}
- H01M 4/0476 . . . . {with molten material}
- H01M 4/0478 . . . . {with dispersions, suspensions or pastes}
- H01M 4/048 . . . . {with dry powder}
- H01M 4/0483 . . . {by methods including the handling of a melt ([H01M 4/0438](#), take precedence)}
- H01M 4/0485 . . . . {Casting}
- H01M 4/0488 . . . . {Alloying}
- H01M 4/049 . . . . {Manufacturing of an active layer by chemical means}
- H01M 4/0492 . . . . {Chemical attack of the support material}
- H01M 4/0495 . . . . {Chemical alloying}
- H01M 4/0497 . . . . {Chemical precipitation}
- H01M 4/06 . . Electrodes for primary cells
- H01M 4/08 . . . Processes of manufacture
- H01M 4/10 . . . . of pressed electrodes with central core, i.e. dollies
- H01M 4/12 . . . . of consumable metal or alloy electrodes ([use of alloy compositions as active materials H01M 4/38](#))
- H01M 4/13 . . Electrodes for accumulators with non-aqueous electrolyte, e.g. for lithium-accumulators; Processes of manufacture thereof

**NOTE**



H01M 4/13  
(continued)

This group does not cover electrodes for accumulators working at high temperatures, e.g. molten sodium electrodes, which subject matter is classified in group [H01M 10/39](#)

- H01M 4/131 . . . Electrodes based on mixed oxides or hydroxides, or on mixtures of oxides or hydroxides, e.g. LiCoOx
- H01M 4/1315 . . . . containing halogen atoms, e.g. LiCoOxFy
- H01M 4/133 . . . Electrodes based on carbonaceous material, e.g. graphite-intercalation compounds or CFx
- H01M 4/134 . . . Electrodes based on metals, Si or alloys
- H01M 4/136 . . . Electrodes based on inorganic compounds other than oxides or hydroxides, e.g. sulfides, selenides, tellurides, halogenides or LiCoFy
- H01M 4/137 . . . Electrodes based on electro-active polymers
- H01M 4/139 . . . Processes of manufacture
- H01M 4/1391 . . . . of electrodes based on mixed oxides or hydroxides, or on mixtures of oxides or hydroxides, e.g. LiCoOx
- H01M 4/13915 . . . . . containing halogen atoms, e.g. LiCoOxFy
- H01M 4/1393 . . . . of electrodes based on carbonaceous material, e.g. graphite-intercalation compounds or CFx
- H01M 4/1395 . . . . of electrodes based on metals, Si or alloys
- H01M 4/1397 . . . . of electrodes based on inorganic compounds other than oxides or hydroxides, e.g. sulfides, selenides, tellurides, halogenides or LiCoFy
- H01M 4/1399 . . . . of electrodes based on electro-active polymers
- H01M 4/14 . . Electrodes for lead-acid accumulators
- H01M 4/16 . . . Processes of manufacture
- H01M 4/18 . . . . of Planté electrodes
- H01M 4/20 . . . . of pasted electrodes
- H01M 4/21 . . . . . Drying of pasted electrodes
- H01M 4/22 . . . . Forming of electrodes
- H01M 4/23 . . . . . Drying or preserving electrodes after forming
- H01M 4/24 . . Electrodes for alkaline accumulators
- H01M 4/242 . . . {Hydrogen storage electrodes}
- H01M 4/244 . . . {Zinc electrodes}
- H01M 4/246 . . . {Cadmium electrodes}
- H01M 4/248 . . . {Iron electrodes}
- H01M 4/26 . . . Processes of manufacture
- H01M 4/28 . . . . Precipitating active material on the carrier
- H01M 4/29 . . . . . by electrochemical methods
- H01M 4/30 . . . . Pressing
- H01M 4/32 . . . Nickel oxide or hydroxide electrodes
- H01M 4/34 . . . Silver oxide or hydroxide electrodes



- H01M 4/36 . . Selection of substances as active materials, active masses, active liquids {(electrode materials of hybrid or double layer capacitors [H01G 11/30-H01G 11/50](#))}
- H01M 4/362 . . . {Composites}
- H01M 4/364 . . . . {as mixtures}
- H01M 4/366 . . . . {as layered products}
- H01M 4/368 . . . {Liquid depolarisers}
- H01M 4/38 . . . of elements or alloys
- H01M 4/381 . . . . {Alkaline or alkaline earth metals elements ([H01M 4/40](#) takes precedence)}
- H01M 4/382 . . . . . {Lithium ([H01M 4/405](#) takes precedence)}
- H01M 4/383 . . . . {Hydrogen absorbing alloys}
- H01M 4/385 . . . . . {of the type  $\text{LaNi}_5$ }
- H01M 4/386 . . . . {Silicon or alloys based on silicon}
- H01M 4/387 . . . . {Tin or alloys based on tin}
- H01M 4/388 . . . . {Halogens}
- H01M 4/40 . . . . Alloys based on alkali metals
- H01M 4/405 . . . . . {Alloys based on lithium}
- H01M 4/42 . . . . Alloys based on zinc
- H01M 4/44 . . . . Alloys based on cadmium
- H01M 4/46 . . . . Alloys based on magnesium or aluminium
- H01M 4/463 . . . . . {Aluminium based}
- H01M 4/466 . . . . . {Magnesium based}
- H01M 4/48 . . . of inorganic oxides or hydroxides
- H01M 4/481 . . . . {of mercury}
- H01M 4/483 . . . . {for non-aqueous cells ([H01M 4/485](#) takes precedence)}
- H01M 4/485 . . . . of mixed oxides or hydroxides for inserting or intercalating light metals, e.g.  $\text{LiTi}_2\text{O}_4$  or  $\text{LiTi}_2\text{OxFy}$  ([H01M 4/505](#), [H01M 4/525](#) take precedence)
- H01M 4/50 . . . . of manganese
- H01M 4/502 . . . . . {for non-aqueous cells ([H01M 4/505](#) takes precedence)}
- H01M 4/505 . . . . of mixed oxides or hydroxides containing manganese for inserting or intercalating light metals, e.g.  $\text{LiMn}_2\text{O}_4$  or  $\text{LiMn}_2\text{OxFy}$
- H01M 4/52 . . . . of nickel, cobalt or iron
- H01M 4/521 . . . . . {of iron for aqueous cells}
- H01M 4/523 . . . . . {for non-aqueous cells ([H01M 4/525](#) takes precedence)}
- H01M 4/525 . . . . of mixed oxides or hydroxides containing iron, cobalt or nickel for inserting or intercalating light metals, e.g.  $\text{LiNiO}_2$ ,  $\text{LiCoO}_2$  or  $\text{LiCoOxFy}$
- H01M 4/54 . . . . of silver
- H01M 4/56 . . . . of lead
- H01M 4/57 . . . . . of "Grey lead", i.e. powders containing lead and lead oxide

- H01M 4/58 . . . of inorganic compounds other than oxides or hydroxides, e.g. sulfides, selenides, tellurides, halogenides or  $\text{LiCoF}_y$
- H01M 4/5805 . . . . {Phosphides}
- H01M 4/581 . . . . {Chalcogenides or intercalation compounds thereof}
- H01M 4/5815 . . . . . {Sulfides}
- H01M 4/582 . . . . {Halogenides}
- H01M 4/5825 . . . . {Oxygenated metallic slats or polyanionic structures, e.g. borates, phosphates, silicates, olivines}

**NOTE**

Polyanionic structures comprises elements not changing oxidation state during electrochemical reaction, e.g. P, Si, B

- H01M 4/583 . . . . Carbonaceous material, e.g. graphite-intercalation compounds or  $\text{CF}_x$
- H01M 4/5835 . . . . . {Comprising fluorine or fluoride salts}
- H01M 4/587 . . . . . for inserting or intercalating light metals
- H01M 4/60 . . . of organic compounds
- H01M 4/602 . . . . {Polymers}
- H01M 4/604 . . . . . {containing aliphatic main chain polymers}
- H01M 4/606 . . . . . {containing aromatic main chain polymers}
- H01M 4/608 . . . . . . {containing heterocyclic rings}
- H01M 4/62 . . Selection of inactive substances as ingredients for active masses, e.g. binders, fillers
- H01M 4/621 . . . {Binders}
- H01M 4/622 . . . . {being polymers}
- H01M 4/623 . . . . . {fluorinated polymers}
- H01M 4/624 . . . {Electric conductive fillers}
- H01M 4/625 . . . . {Carbon or graphite}
- H01M 4/626 . . . . {Metals}
- H01M 4/627 . . . {Expanders for lead-acid accumulators}
- H01M 4/628 . . . {Inhibitors, e.g. gassing inhibitors, corrosion inhibitors}
- H01M 4/64 . . Carriers or collectors {(current collector for hybrid or electric double layer capacitors [H01G 11/66](#))}
- H01M 4/66 . . . Selection of materials
- H01M 4/661 . . . . {Metal or alloys, e.g. alloy coatings ([H01M 4/669](#) take precedence)}
- H01M 4/662 . . . . . {Alloys (collectors of lead alloys [H01M 4/685](#))}
- H01M 4/663 . . . . {containing carbon or carbonaceous materials as conductive part, e.g. graphite, carbon fibres}
- H01M 4/664 . . . . {Ceramic materials}
- H01M 4/665 . . . . {Composites}
- H01M 4/666 . . . . . {in the form of mixed materials ([H01M 4/668](#) takes precedence)}
- H01M 4/667 . . . . . {in the form of layers, e.g. coatings}
- H01M 4/668 . . . . {Composites of electroconductive material and synthetic resins}

H01M 4/669	. . . . {Steels}
H01M 4/68	. . . . for use in lead-acid accumulators
H01M 4/685	. . . . . {Lead alloys}
H01M 4/70	. . . characterised by shape or form
H01M 4/72	. . . . Grids
H01M 4/73	. . . . . for lead-acid accumulators, e.g. frame plates
H01M 4/74	. . . . . Meshes or woven material; Expanded metal
H01M 4/742	. . . . . . {perforated material}
H01M 4/745	. . . . . . {Expanded metal}
H01M 4/747	. . . . . . {Woven material}
H01M 4/75	. . . . Wires, rods or strips
H01M 4/76	. . . . Containers for holding the active material, e.g. tubes, capsules
H01M 4/762	. . . . . {Porous or perforated metallic containers}
H01M 4/765	. . . . . {Tubular type or pencil type electrodes; tubular or multitubular sheaths or covers of insulating material for said tubular-type electrodes}
H01M 4/767	. . . . . . {Multitubular sheaths or covers}
H01M 4/78	. . . . Shapes other than plane or cylindrical, e.g. helical
H01M 4/80	. . . . Porous plates, e.g. sintered carriers
H01M 4/801	. . . . . {Sintered carriers}
H01M 4/803	. . . . . . {of only powdered material}
H01M 4/805	. . . . . . {of powdered and fibrous material}
H01M 4/806	. . . . . . {Nonwoven fibrous fabric containing only fibres}
H01M 4/808	. . . . . . {Foamed, spongy materials}
H01M 4/82	. . . Multi-step processes for manufacturing carriers for lead-acid accumulators (single step processes see the relevant subclasses, e.g. <a href="#">B21D</a> ; <a href="#">B22D</a> )
H01M 4/84	. . . . involving casting
H01M 4/86	. Inert electrodes with catalytic activity, e.g. for fuel cells
H01M 4/8605	. . {Porous electrodes}
H01M 4/861	. . . {with a gradient in the porosity}
H01M 4/8615	. . . {Bifunctional electrodes for rechargeable cells}
H01M 4/8621	. . . {containing only metallic or ceramic material, e.g. made by sintering or sputtering}
H01M 4/8626	. . . {characterised by the form}
H01M 4/8631	. . . . {Bipolar electrodes}
H01M 4/8636	. . {with a gradient in another property than porosity ( <a href="#">H01M 4/861</a> takes precedence)}
H01M 4/8642	. . . {Gradient in composition}
H01M 4/8647	. . {consisting of more than one material, e.g. consisting of composites}
H01M 4/8652	. . . {as mixture}
H01M 4/8657	. . . {layered}

H01M 4/8663	. . {Selection of inactive substances as ingredients for catalytic active masses, e.g. binders, fillers}
H01M 4/8668	. . . {Binders}
H01M 4/8673	. . . {Electrically conductive fillers}
H01M 2004/8678	. . {characterised by the polarity}
H01M 2004/8684	. . . {Negative electrodes}
H01M 2004/8689	. . . {Positive electrodes}
H01M 2004/8694	. . . {Bipolar electrodes}
H01M 4/88	. . Processes of manufacture
H01M 4/8803	. . . {Supports for the deposition of the catalytic active composition ( <a href="#">H01M 4/90</a> takes precedence)}
H01M 4/8807	. . . . {Gas diffusion layers}
H01M 4/881	. . . . {Electrolytic membranes}
H01M 4/8814	. . . . {Temporary supports, e.g. decal}
H01M 4/8817	. . . {Treatment of supports before application of the catalytic active composition ( <a href="#">coated porous composites H01M 8/0245</a> )}
H01M 4/8821	. . . . {Wet proofing}
H01M 4/8825	. . . {Methods for deposition of the catalytic active composition}
H01M 4/8828	. . . . {Coating with slurry or ink}
H01M 4/8832	. . . . . {Ink jet printing}
H01M 4/8835	. . . . . {Screen printing}
H01M 4/8839	. . . . . {Painting}
H01M 4/8842	. . . . {Coating using a catalyst salt precursor in solution followed by evaporation and reduction of the precursor}
H01M 4/8846	. . . . {Impregnation}
H01M 4/885	. . . . . {followed by reduction of the catalyst salt precursor}
H01M 4/8853	. . . . {Electrodeposition}
H01M 4/8857	. . . . {Casting, e.g. tape casting, vacuum slip casting}
H01M 4/886	. . . . {Powder spraying, e.g. wet or dry powder spraying, plasma spraying}
H01M 4/8864	. . . . {Extrusion}
H01M 4/8867	. . . . {Vapour deposition}
H01M 4/8871	. . . . . {Sputtering}
H01M 4/8875	. . . {Methods for shaping the electrode into free-standing bodies, like sheets, films or grids, e.g. moulding, hot-pressing, casting without support, extrusion without support}
H01M 4/8878	. . . {Treatment steps after deposition of the catalytic active composition or after shaping of the electrode being free-standing body}
H01M 4/8882	. . . . {Heat treatment, e.g. drying, baking}
H01M 4/8885	. . . . . {Sintering or firing}
H01M 4/8889	. . . . . {Cosintering or cofiring of a catalytic active layer with another type of layer}
H01M 4/8892	. . . . {Impregnation or coating of the catalyst layer, e.g. by an ionomer}

- H01M 4/8896 . . . . {Pressing, rolling, calendering ([membrane electrode assemblies H01M 8/1004](#))}
- H01M 4/90 . . Selection of catalytic material
- H01M 4/9008 . . . {Organic or organo-metallic compounds}
- H01M 4/9016 . . . {Oxides, hydroxides or oxygenated metallic salts}
- H01M 4/9025 . . . . {Oxides specially used in fuel cell operating at high temperature, e.g. SOFC}
- H01M 4/9033 . . . . . {Complex oxides, optionally doped, of the type  $M_1MeO_3$ ,  $M_1$  being an alkaline earth metal or a rare earth,  $Me$  being a metal, e.g. perovskites}
- H01M 4/9041 . . . {Metals or alloys ([H01M 4/92](#) takes precedence)}
- H01M 4/905 . . . . {specially used in fuel cell operating at high temperature, e.g. SOFC}
- H01M 4/9058 . . . . . {of noble metals or noble-metal based alloys}
- H01M 4/9066 . . . . . {of metal-ceramic composites or mixtures, e.g. cermets}
- H01M 4/9075 . . . {Catalytic material supported on carriers, e.g. powder carriers ([H01M 4/8807](#), [H01M 4/881](#), [H01M 4/8814](#), [H01M 4/925](#) take precedence)}
- H01M 4/9083 . . . . {on carbon or graphite}
- H01M 4/9091 . . . {Unsupported catalytic particles; loose particulate catalytic materials, e.g. in fluidised state}
- H01M 4/92 . . . Metals of platinum group ([H01M 4/94](#), [H01M 4/9058](#) take precedence)
- H01M 4/921 . . . . {Alloys or mixtures with metallic elements}
- H01M 4/923 . . . . {Compounds thereof with non-metallic elements}
- H01M 4/925 . . . . {supported on carriers, e.g. powder carriers}
- H01M 4/926 . . . . . {on carbon or graphite}
- H01M 4/928 . . . . {Unsupported catalytic particles; loose particulate catalytic materials, e.g. in fluidised state}
- H01M 4/94 . . Non-porous diffusion electrodes, e.g. palladium membranes, ion exchange membranes
- H01M 4/96 . . Carbon-based electrodes
- H01M 4/98 . . Raney-type electrodes

**H01M 6/00****Primary cells; Manufacture thereof****NOTE**

In this group, primary cells are electrochemical generators in which the cell energy is present in chemical form and is not regenerated.

- H01M 6/005 . {Devices for making primary cells}
- H01M 6/02 . Details ([of non-active parts H01M 2/00](#); [of electrodes H01M 4/00](#))
- H01M 6/04 . Cells with aqueous electrolyte
- H01M 6/045 . . {characterised by aqueous electrolyte}
- H01M 6/06 . . Dry cells, i.e. cells wherein the electrolyte is rendered non-fluid
- H01M 6/08 . . . with cup shaped electrodes
- H01M 6/085 . . . . {of the reversed type, i.e. anode in the centre}

- H01M 6/10 . . . with wound or folded electrodes
- H01M 6/103 . . . . {Cells with electrode of only one polarity being folded or wound}
- H01M 2006/106 . . . . {Elliptic wound cells}
- H01M 6/12 . . . with flat electrodes
- H01M 6/14 . Cells with non-aqueous electrolyte {(H01M 10/05 takes precedence)}
- H01M 6/145 . . {containing ammonia}
- H01M 6/16 . . with organic electrolyte (H01M 6/18, {H01M 10/05 take precedence})
- H01M 6/162 . . . {characterised by the electrolyte}
- H01M 6/164 . . . . {by the solvent (organic electrolyte solvents H01M 2300/0028)}
- H01M 6/166 . . . . {by the solute}
- H01M 6/168 . . . . {by additives}
- H01M 6/18 . . with solid electrolyte
- H01M 6/181 . . . {with polymeric electrolytes (organic polymers electrolytes H01M 2300/0082)}
- H01M 6/182 . . . {with halogenide as solid electrolyte (halide solid electrolytes H01M 2300/008)}
- H01M 6/183 . . . . {with fluoride as solid electrolyte}
- H01M 6/185 . . . {with oxides, hydroxides or oxysalts as solid electrolytes (oxides solid electrolyte H01M 2300/0071)}
- H01M 6/186 . . . . {Only oxysalts-containing solid electrolytes}
- H01M 6/187 . . . {Solid electrolyte characterised by the form (layered solid electrolytes H01M 2300/0094)}
- H01M 6/188 . . . {Processes of manufacture}
- H01M 6/20 . . . working at high temperature (deferred-action thermal cells H01M 6/36)
- H01M 6/22 . Immobilising of electrolyte
- H01M 6/24 . Cells comprising two different electrolytes
- H01M 6/26 . Cells without oxidising active material, e.g. Volta cells
- H01M 6/28 . Standard cells, e.g. Weston cells
- H01M 6/30 . Deferred-action cells
- H01M 6/32 . . activated through external addition of electrolyte or of electrolyte components
- H01M 6/34 . . . Immersion cells, e.g. sea-water cells
- H01M 6/36 . . containing electrolyte and made operational by physical means, e.g. thermal cells (thermoelectric solid state devices H01L 35/00, H01L 37/00)
- H01M 6/38 . . . by mechanical means
- H01M 6/385 . . . . {by insertion of electrodes}
- H01M 6/40 . Printed batteries, {e.g. thin film batteries}
- H01M 6/42 . Grouping of primary cells into batteries (H01M 6/40 takes precedence)
- H01M 6/425 . . {Multimode batteries, batteries with "reserve cells"}
- H01M 6/44 . . of tubular or cup-shaped cells
- H01M 6/46 . . of flat cells
- H01M 6/48 . . . with bipolar electrodes

- H01M 6/485 . . . . {Side-by-side bipolar batteries}
- H01M 6/50 . Methods or arrangements for servicing or maintenance, e.g. maintaining operating temperature {(cells or batteries combined with safety devices [H01M 2200/00](#))}
- H01M 6/5005 . . {Auxiliary electrodes}
- H01M 6/5011 . . {for several cells simultaneously or successively}
- H01M 6/5016 . . . {Multimode utilisation}
- H01M 6/5022 . . {Arrangements for moving electrodes or separating elements}
- H01M 6/5027 . . {Dummy cells}
- H01M 6/5033 . . {used as charging means for another battery}
- H01M 6/5038 . . {Heating or cooling of cells or batteries}
- H01M 6/5044 . . {Cells or batteries structurally combined with cell condition indicating means ([H01M 2/34](#) takes precedence)}
- H01M 6/505 . . . {Cells combined with indicating means for externally visualisation of the condition, e.g. by change of colour or of light intensity}
- H01M 6/5055 . . . {End of discharge indicated by a voltage step}
- H01M 6/5061 . . . {cells combined with sound indicating means}
- H01M 6/5066 . . {Type recognition}
- H01M 6/5072 . . {Preserving or storing cells}
- H01M 6/5077 . . {Regeneration of reactants or electrolyte}
- H01M 6/5083 . . {Testing apparatus}
- H01M 6/5088 . . {Initial activation; predischARGE; Stabilisation of initial voltage}
- H01M 2006/5094 . . {Aspects relating to capacity ratio of electrolyte/electrodes or anode/cathode}
- H01M 6/52 . Reclaiming serviceable parts of waste cells or batteries, {e.g. recycling}

**H01M 8/00****Fuel cells; Manufacture thereof****NOTE**

Fuel cells are electrochemical generators wherein the reactants are supplied from outside

- H01M 8/002 . {Shape, form of a fuel cell}
- H01M 8/004 . . {Cylindrical, tubular or wound}
- H01M 8/006 . . {Flat}
- H01M 8/008 . Disposal or recycling of fuel cells
- H01M 8/02 . Details ([electrodes H01M 4/86](#) - [H01M 4/98](#))
- H01M 8/0202 . . Collectors; Separators, e.g. bipolar separators; Interconnectors
- H01M 8/0204 . . . Non-porous and characterised by the material
- H01M 8/0206 . . . . Metals or alloys
- H01M 8/0208 . . . . . Alloys
- H01M 8/021 . . . . . Alloys based on iron
- H01M 8/0213 . . . . Gas-impermeable carbon-containing materials
- H01M 8/0215 . . . . Glass; Ceramic materials



- H01M 8/0217 . . . . . Complex oxides, optionally doped, of the type  $\text{AMO}_3$ , A being an alkaline earth metal or rare earth metal and M being a metal, e.g. perovskites
- H01M 8/0219 . . . . . {Chromium complex oxides}
- H01M 8/0221 . . . . . Organic resins; Organic polymers
- H01M 8/0223 . . . . . Composites
- H01M 8/0226 . . . . . in the form of mixtures
- H01M 8/0228 . . . . . in the form of layered or coated products
- H01M 8/023 . . . . . Porous and characterised by the material
- H01M 8/0232 . . . . . Metals or alloys
- H01M 8/0234 . . . . . Carbonaceous material
- H01M 8/0236 . . . . . Glass; Ceramics; Cermets
- H01M 8/0239 . . . . . Organic resins; Organic polymers
- H01M 8/0241 . . . . . Composites
- H01M 8/0243 . . . . . in the form of mixtures
- H01M 8/0245 . . . . . in the form of layered or coated products
- H01M 8/0247 . . . . . characterised by the form (characterised by a channel configuration [H01M 8/0258](#))
- H01M 8/025 . . . . . semicylindrical
- H01M 8/0252 . . . . . tubular
- H01M 8/0254 . . . . . corrugated or undulated
- H01M 8/0256 . . . . . Vias, i.e. connectors passing through the separator material
- H01M 8/0258 . . . . . characterised by the configuration of channels, e.g. by the flow field of the reactant or coolant

**WARNING**

Group [H01M 8/0258](#) is incomplete pending reclassification of documents from group [H01M 8/0267](#) and impacted by reclassification into [H01M 8/2483](#).

Groups [H01M 8/0258](#), [H01M 8/0267](#) and [H01M 8/2483](#) should be considered in order to perform a complete search.

- H01M 8/026 . . . . . characterised by grooves, e.g. their pitch or depth

**WARNING**

Groups [H01M 8/026](#)-[H01M 8/0265](#) are incomplete pending reclassification of documents from group [H01M 8/0267](#).

Group [H01M 8/0267](#) should be considered when searching any group of the range [H01M 8/026](#)-[H01M 8/0265](#) in order to perform a complete search.

- H01M 8/0263 . . . . . having meandering or serpentine paths
- H01M 8/0265 . . . . . the reactant or coolant channels having varying cross sections

- H01M 8/0267 . . . having heating or cooling means, e.g. heaters or coolant flow channels

**WARNING**

Group [H01M 8/0267](#) is impacted by reclassification into groups [H01M 8/0258](#) - [H01M 8/0265](#) and [H01M 8/2483](#).

Groups [H01M 8/0267](#) should be considered when searching any group in the range [H01M 8/0258](#) - [H01M 8/0265](#) or group [H01M 8/2483](#).

- H01M 8/0269 . . . {Separators, collectors or interconnectors including a printed circuit board}

- H01M 8/0271 . . . Sealing or supporting means around electrodes, matrices or membranes

**WARNING**

Group [H01M 8/0271](#) is incomplete pending reclassification of documents from group [H01M 8/0297](#).

Group [H01M 8/0297](#) and [H01M 8/0271](#) should be considered in order to perform a complete search.

- H01M 8/0273 . . . with sealing or supporting means in the form of a frame

**WARNING**

Group [H01M 8/0273](#) is incomplete pending reclassification of documents from group [H01M 8/0276](#).

Group [H01M 8/0276](#) and [H01M 8/0273](#) should be considered in order to perform a complete search.

- H01M 8/0276 . . . Sealing means characterised by their form ([H01M 8/0273](#) takes precedence)

**WARNING**

Group [H01M 8/0276](#) is impacted by reclassification into group [H01M 8/0273](#).

Groups [H01M 8/0276](#) and [H01M 8/0273](#) should be considered in order to perform a complete search.

- H01M 8/0278 . . . . {O-rings}

- H01M 8/028 . . . Sealing means characterised by their material

- H01M 8/0282 . . . . Inorganic material

- H01M 8/0284 . . . . Organic resins; Organic polymers

- H01M 8/0286 . . . Processes for forming seals

- H01M 8/0289 . . Means for holding the electrolyte ([solid polymer electrolytes H01M 8/1018](#))

- H01M 8/0293 . . . Matrices for immobilising electrolyte solutions

- H01M 8/0295 . . . Matrices for immobilising electrolyte melts

- H01M 8/0297 . . Arrangements for joining electrodes, reservoir layers, heat exchange units or bipolar separators to each other ([H01M 8/0271](#) takes precedence)

**WARNING**

Group [H01M 8/0297](#) is impacted by reclassification into groups [H01M 8/0271](#).

Groups [H01M 8/0297](#) and [H01M 8/0271](#) should be considered in order to perform a complete search.

- H01M 8/04 . Auxiliary arrangements, e.g. for control of pressure or for circulation of fluids

**NOTE**

In this group, multi-aspect classification is applied, so that subject matter characterised by aspects covered by more than one of its subgroups should be classified in each of those subgroups.

- H01M 8/04007 . . related to heat exchange
- H01M 8/04014 . . . Heat exchange using gaseous fluids; Heat exchange by combustion of reactants
- H01M 8/04022 . . . . {Heating by combustion}
- H01M 8/04029 . . . Heat exchange using liquids
- H01M 8/04037 . . . {Electrical heating}
- H01M 8/04044 . . . Purification of heat exchange media
- H01M 8/04052 . . . {Storage of heat in the fuel cell system}
- H01M 8/04059 . . . {Evaporative processes for the cooling of a fuel cell}
- H01M 8/04067 . . . {Heat exchange or temperature measuring elements, thermal insulation, e.g. heat pipes, heat pumps, fins}
- H01M 8/04074 . . . . {Heat exchange unit structures specially adapted for fuel cell ([heat exchanger for fuel cells F28D 2021/0043](#))}
- H01M 8/04082 . . Arrangements for control of reactant parameters, e.g. pressure or concentration
- H01M 8/04089 . . . of gaseous reactants
- H01M 8/04097 . . . . {with recycling of the reactants ([H01M 8/04119](#), [H01M 8/04104](#) take precedence)}
- H01M 8/04104 . . . . {Regulation of differential pressures}
- H01M 8/04111 . . . . using a compressor turbine assembly
- H01M 8/04119 . . . . with simultaneous supply or evacuation of electrolyte; Humidifying or dehumidifying
- H01M 8/04126 . . . . . {Humidifying}
- H01M 8/04134 . . . . . . {by coolants}
- H01M 8/04141 . . . . . . {by water containing exhaust gases}
- H01M 8/04149 . . . . . . {by diffusion, e.g. making use of membranes}
- H01M 8/04156 . . . . . {with product water removal}
- H01M 8/04164 . . . . . . {by condensers, gas-liquid separators or filters}
- H01M 8/04171 . . . . . . {using adsorbents, wicks or hydrophilic material}
- H01M 8/04179 . . . . . . {by purging or increasing flow or pressure of reactants}

- H01M 8/04186 . . . of liquid-charged or electrolyte-charged reactants
- H01M 8/04194 . . . . {Concentration measuring cells}
- H01M 8/04197 . . . {Preventing means for fuel crossover}
- H01M 8/04201 . . . {Reactant storage and supply, e.g. means for feeding, pipes}
- H01M 8/04208 . . . . {Cartridges, cryogenic media or cryogenic reservoirs}
- H01M 8/04216 . . . . {characterised by the choice for a specific material, e.g. carbon, hydride, absorbent}
- H01M 8/04223 . . during start-up or shut-down; Depolarisation or activation, e.g. purging; Means for short-circuiting defective fuel cells

**WARNING**

Group [H01M 8/04223](#) is impacted by reclassification into groups groups [H01M 8/04225-H01M 8/04228](#) and [H01M 8/043-H01M 8/04303](#).

Groups [H01M 8/04223](#) should be considered when searching any group of the ranges [H01M 8/04225 - H01M 8/04228](#) and [H01M 8/043-H01M 8/04303](#) in order to perform a complete search.

- H01M 8/04225 . . . during start-up

**WARNING**

Groups [H01M 8/04225-H01M 8/04228](#) are incomplete pending reclassification of documents from group [H01M 8/04223](#).

Group [H01M 8/04223](#) should be considered when searching any group of the range [H01M 8/04225-H01M 8/04228](#) in order to perform a complete search.

- H01M 8/04228 . . . during shut-down
- H01M 8/04231 . . . {Purging of the reactants}
- H01M 8/04238 . . . {Depolarisation}
- H01M 8/04246 . . . {Short circuiting means for defective fuel cells (detection of defective fuel cells [H01M 8/04664](#), methods for shunting fuel cells [H01M 8/04955](#))}
- H01M 8/04253 . . . {Means for solving freezing problems}
- H01M 8/04268 . . . {Heating of fuel cells during the start-up of the fuel cells}
- H01M 8/04276 . . Arrangements for managing the electrolyte stream, e.g. heat exchange
- H01M 8/04283 . . . {Supply means of electrolyte to or in matrix-fuel cells}
- H01M 8/04291 . . Arrangements for managing water in solid electrolyte fuel cell systems ([H01M 8/04119](#) takes precedence)
- H01M 8/04298 . . Processes for controlling fuel cells or fuel cell systems
- H01M 8/043 . . . applied during specific periods

**WARNING**

Groups [H01M 8/043 - H01M 8/04303](#) are incomplete pending reclassification of documents from group [H01M 8/04223](#).

Group [H01M 8/04223](#) should be considered any group of the range [H01M 8/043-H01M 8/04303](#) in order to perform a complete search.

- H01M 8/04302 . . . . applied during start-up

H01M 8/04303	. . . .	applied during shut-down
H01M 8/04305	. . .	{Modeling, demonstration models of fuel cells, e.g. for training purposes}
H01M 8/04313	. . .	characterised by the detection or assessment of variables; characterised by the detection or assessment of failure or abnormal function
H01M 8/0432	. . . .	Temperature; Ambient temperature
H01M 8/04328	. . . . .	{of anode reactants at the inlet or inside the fuel cell}
H01M 8/04335	. . . . .	{of cathode reactants at the inlet or inside the fuel cell}
H01M 8/04343	. . . . .	{of anode exhausts}
H01M 8/0435	. . . . .	{of cathode exhausts}
H01M 8/04358	. . . . .	{of the coolant}
H01M 8/04365	. . . . .	{of other components of a fuel cell or fuel cell stacks}
H01M 8/04373	. . . . .	{of auxiliary devices, e.g. reformers, compressors, burners}
H01M 8/0438	. . . .	Pressure; Ambient pressure; Flow
H01M 8/04388	. . . . .	{of anode reactants at the inlet or inside the fuel cell}
H01M 8/04395	. . . . .	{of cathode reactants at the inlet or inside the fuel cell}
H01M 8/04402	. . . . .	{of anode exhausts}
H01M 8/0441	. . . . .	{of cathode exhausts}
H01M 8/04417	. . . . .	{of the coolant}
H01M 8/04425	. . . . .	{at auxiliary devices, e.g. reformers, compressors, burners}
H01M 8/04432	. . . . .	{Pressure differences, e.g. between anode and cathode}
H01M 8/0444	. . . .	Concentration; Density ( <a href="#">H01M 8/04492</a> takes precedence)
H01M 8/04447	. . . . .	{of anode reactants at the inlet or inside the fuel cell}
H01M 8/04455	. . . . .	{of cathode reactants at the inlet or inside the fuel cell}
H01M 8/04462	. . . . .	{of anode exhausts}
H01M 8/0447	. . . . .	{of cathode exhausts}
H01M 8/04477	. . . . .	{of the electrolyte}
H01M 8/04485	. . . . .	{of the coolant}
H01M 8/04492	. . . .	Humidity; Ambient humidity; Water content
H01M 8/045	. . . . .	{of anode reactants at the inlet or inside the fuel cell}
H01M 8/04507	. . . . .	{of cathode reactants at the inlet or inside the fuel cell}
H01M 8/04514	. . . . .	{of anode exhausts}
H01M 8/04522	. . . . .	{of cathode exhausts}
H01M 8/04529	. . . . .	{of the electrolyte}
H01M 8/04537	. . . .	Electric variables
H01M 8/04544	. . . . .	{Voltage}
H01M 8/04552	. . . . .	{of the individual fuel cell}
H01M 8/04559	. . . . .	{of fuel cell stacks}
H01M 8/04567	. . . . .	{of auxiliary devices, e.g. batteries, capacitors}
H01M 8/04574	. . . . .	{Current}
H01M 8/04582	. . . . .	{of the individual fuel cell}

H01M 8/04589	. . . . . {of fuel cell stacks}
H01M 8/04597	. . . . . {of auxiliary devices, e.g. batteries, capacitors}
H01M 8/04604	. . . . . {Power, energy, capacity or load}
H01M 8/04611	. . . . . {of the individual fuel cell}
H01M 8/04619	. . . . . {of fuel cell stacks}
H01M 8/04626	. . . . . {of auxiliary devices, e.g. batteries, capacitors}
H01M 8/04634	. . . . . {Other electric variables, e.g. resistance or impedance}
H01M 8/04641	. . . . . {of the individual fuel cell}
H01M 8/04649	. . . . . {of fuel cell stacks}
H01M 8/04656	. . . . . {of auxiliary devices, e.g. batteries, capacitors}
H01M 8/04664	. . . . . Failure or abnormal function
H01M 8/04671	. . . . . {of the individual fuel cell}
H01M 8/04679	. . . . . {of fuel cell stacks}
H01M 8/04686	. . . . . {of auxiliary devices, e.g. batteries, capacitors}
H01M 8/04694	. . . characterised by variables to be controlled
H01M 8/04701	. . . . . Temperature
H01M 8/04708	. . . . . {of fuel cell reactants}
H01M 8/04716	. . . . . {of fuel cell exhausts}
H01M 8/04723	. . . . . {of the coolant}
H01M 8/04731	. . . . . {of other components of a fuel cell or fuel cell stacks}
H01M 8/04738	. . . . . {of auxiliary devices, e.g. reformer, compressor, burner}
H01M 8/04746	. . . . . Pressure; Flow
H01M 8/04753	. . . . . {of fuel cell reactants}
H01M 8/04761	. . . . . {of fuel cell exhausts}
H01M 8/04768	. . . . . {of the coolant}
H01M 8/04776	. . . . . {at auxiliary devices, e.g. reformer, compressor, burner}
H01M 8/04783	. . . . . {Pressure differences, e.g. between anode and cathode}
H01M 8/04791	. . . . . Concentration; Density ( <a href="#">H01M 8/04828</a> takes precedence)
H01M 8/04798	. . . . . {of fuel cell reactants}
H01M 8/04805	. . . . . {of fuel cell exhausts}
H01M 8/04813	. . . . . {of the coolant}
H01M 8/0482	. . . . . {of the electrolyte}
H01M 8/04828	. . . . . Humidity; Water content
H01M 8/04835	. . . . . {of fuel cell reactants}
H01M 8/04843	. . . . . {of fuel cell exhausts}
H01M 8/0485	. . . . . {of the electrolyte}
H01M 8/04858	. . . . . Electric variables
H01M 8/04865	. . . . . {Voltage}
H01M 8/04873	. . . . . {of the individual fuel cell}
H01M 8/0488	. . . . . {of fuel cell stacks}

H01M 8/04888	. . . . . {of auxiliary devices, e.g. batteries, capacitors}
H01M 8/04895	. . . . . {Current}
H01M 8/04902	. . . . . {of the individual fuel cell}
H01M 8/0491	. . . . . {of fuel cell stacks}
H01M 8/04917	. . . . . {of auxiliary devices, e.g. batteries, capacitors}
H01M 8/04925	. . . . . {Power, energy, capacity or load}
H01M 8/04932	. . . . . {of the individual fuel cell}
H01M 8/0494	. . . . . {of fuel cell stacks}
H01M 8/04947	. . . . . {of auxiliary devices, e.g. batteries, capacitors}
H01M 8/04949	. . . . . {other electric variables, e.g. resistance or impedance}
H01M 8/04951	. . . . . {of the individual fuel cell}
H01M 8/04952	. . . . . {of fuel cell stacks}
H01M 8/04953	. . . . . {of auxiliary devices, e.g. batteries, capacitors}
H01M 8/04955	. . . . . Shut-off or shut-down of fuel cells
H01M 8/04992	. . . characterised by the implementation of mathematical or computational algorithms, e.g. feedback control loops, fuzzy logic, neural networks or artificial intelligence
H01M 8/06	. Combination of fuel cells with means for production of reactants or for treatment of residues ( <a href="#">regenerative fuel cells H01M 8/18</a> )
H01M 8/0606	. . with means for production of gaseous reactants
H01M 8/0612	. . . from carbon-containing material
H01M 8/0618	. . . . {Reforming processes, e.g. autothermal, partial oxidation or steam reforming}
H01M 8/0625	. . . . {in a modular combined reactor/fuel cell structure}
H01M 8/0631	. . . . {Reactor construction specially adapted for combination reactor/fuel cell ( <a href="#">hydrogen C01B 3/00</a> ; <a href="#">reactors for physicochemical processes B01J 19/00</a> )}
H01M 8/0637	. . . . Direct internal reforming at the anode of the fuel cell
H01M 8/0643	. . . . {Gasification of solid fuel}
H01M 8/065	. . . by dissolution of metals or alloys; by dehydriding metallic substances
H01M 8/0656	. . . by electrochemical means ( <a href="#">H01M 8/065 takes precedence</a> )
H01M 8/0662	. . Treatment of gaseous reactants or gaseous residues, e.g. cleaning
H01M 8/0668	. . . Removal of carbon monoxide or carbon dioxide
H01M 8/0675	. . . {Removal of sulfur}
H01M 8/0681	. . . {Reactant purification by the use of electrochemical cells}
H01M 8/0687	. . . {Reactant purification by the use of membranes or filters}
H01M 8/0693	. . {Treatment of the electrolyte residue, e.g. reconcentrating}
H01M 8/08	. Fuel cells with aqueous electrolytes
H01M 8/083	. . Alkaline fuel cells
H01M 8/086	. . Phosphoric acid fuel cells [PAFC]
H01M 8/10	. Fuel cells with solid electrolytes



- H01M 8/1004 . . characterised by membrane-electrode assemblies [MEA] ([H01M 8/12 takes precedence](#))
- H01M 8/1006 . . . Corrugated, curved or wave-shaped MEA
- H01M 8/1007 . . with both reactants being gaseous or vaporised ([H01M 8/12 takes precedence](#))
- H01M 8/1009 . . with one of the reactants being liquid, solid or liquid-charged ([H01M 8/12 takes precedence](#))
- H01M 8/1011 . . . Direct alcohol fuel cells [DAFC], e.g. direct methanol fuel cells [DMFC]
- H01M 8/1013 . . . . {Other direct alcohol fuel cells [DAFC] (DMFCs [H01M 8/1011](#))}
- H01M 8/1016 . . characterised by the electrolyte material ([H01M 8/12 takes precedence](#))
- H01M 8/1018 . . . Polymeric electrolyte materials
- H01M 8/102 . . . . characterised by the chemical structure of the main chain of the ion-conducting polymer

**NOTE**

When classifying in this group, structures having two or more heteroatoms belonging to the groups O, P, N, S or Si must be completely identified by classification in all relevant subgroups.

- H01M 8/1023 . . . . . having only carbon, e.g. polyarylenes, polystyrenes or polybutadiene-styrenes
- H01M 8/1025 . . . . . having only carbon and oxygen, e.g. polyethers, sulfonated polyetheretherketones [S-PEEK], sulfonated polysaccharides, sulfonated celluloses or sulfonated polyesters
- H01M 8/1027 . . . . . having carbon, oxygen and other atoms, e.g. sulfonated polyethersulfones [S-PES]
- H01M 8/103 . . . . . having nitrogen, e.g. sulfonated polybenzimidazoles [S-PBI], polybenzimidazoles with phosphoric acid, sulfonated polyamides [S-PA] or sulfonated polyphosphazenes [S-PPh]
- H01M 8/1032 . . . . . having sulfur, e.g. sulfonated-polyethersulfones [S-PES]
- H01M 8/1034 . . . . . having phosphorus, e.g. sulfonated polyphosphazenes [S-PPh]
- H01M 8/1037 . . . . . having silicon, e.g. sulfonated crosslinked polydimethylsiloxanes
- H01M 8/1039 . . . . . halogenated, e.g. sulfonated polyvinylidene fluorides
- H01M 8/1041 . . . . . Polymer electrolyte composites, mixtures or blends
- H01M 8/1044 . . . . . Mixtures of polymers, of which at least one is ionically conductive
- H01M 8/1046 . . . . . Mixtures of at least one polymer and at least one additive
- H01M 8/1048 . . . . . . Ion-conducting additives, e.g. ion-conducting particles, heteropolyacids, metal phosphate or polybenzimidazole with phosphoric acid
- H01M 8/1051 . . . . . . Non-ion-conducting additives, e.g. stabilisers, SiO<sub>2</sub> or ZrO<sub>2</sub>
- H01M 8/1053 . . . . . consisting of layers of polymers with at least one layer being ionically conductive
- H01M 8/1055 . . . . . {Inorganic layers on the polymer electrolytes, e.g. inorganic coatings}
- H01M 8/1058 . . . . . characterised by a porous support having no ion-conducting properties

H01M 8/106	. . . . .	characterised by the chemical composition of the porous support
H01M 8/1062	. . . . .	characterised by the physical properties of the porous support, e.g. its porosity or thickness
H01M 8/1065	. . . . .	characterised by the form, e.g. perforated or wave-shaped
H01M 8/1067	. . . . .	characterised by their physical properties, e.g. porosity, ionic conductivity or thickness
H01M 8/1069	. . . . .	characterised by the manufacturing processes
H01M 8/1072	. . . . .	by chemical reactions, e.g. in situ polymerisation or in situ crosslinking
H01M 8/1074	. . . . .	{Sol-gel processes}
H01M 8/1076	. . . . .	{Micromachining techniques, e.g. masking, etching steps, photolithography}
H01M 8/1079	. . . . .	{Inducing porosity into non porous precursors membranes, e.g. leaching, pore stretching}
H01M 8/1081	. . . . .	starting from solutions, dispersions or slurries exclusively of polymers
H01M 8/1083	. . . . .	{Starting from polymer melts other than monomer melts}
H01M 8/1086	. . . . .	After-treatment of the membrane other than by polymerisation
H01M 8/1088	. . . . .	Chemical modification, e.g. sulfonation
H01M 8/109	. . . . .	{thermal other than drying, e.g. sintering}
H01M 8/1093	. . . . .	{mechanical, e.g. pressing, puncturing}
H01M 2008/1095	. .	{Fuel cells with polymeric electrolytes}
H01M 8/1097	. .	Fuel cells applied on a support, e.g. miniature fuel cells deposited on silica supports
H01M 8/12	. .	operating at high temperature, e.g. with stabilised ZrO <sub>2</sub> electrolyte
H01M 8/1213	. . .	characterised by the electrode/electrolyte combination or the supporting material
H01M 8/122	. . . .	Corrugated, curved or wave-shaped MEA
H01M 8/1226	. . . .	characterised by the supporting layer
H01M 8/1231	. . .	with both reactants being gaseous or vaporised
H01M 8/1233	. . .	with one of the reactants being liquid, solid or liquid-charged
H01M 8/124	. . .	characterised by the process of manufacturing or by the material of the electrolyte
H01M 8/1246	. . . .	the electrolyte consisting of oxides
H01M 8/1253	. . . . .	the electrolyte containing zirconium oxide
H01M 8/126	. . . . .	the electrolyte containing cerium oxide
H01M 8/1266	. . . . .	{the electrolyte containing bismuth oxide}
H01M 8/1273	. . . . .	{Fuel cells with solid halide electrolytes (solid halide electrolyte H01M 2300/008)}
H01M 2008/128	. . .	{Fuel cells with solid halide electrolytes (solid halide electrolyte H01M 2300/008)}
H01M 8/1286	. . .	Fuel cells applied on a support, e.g. miniature fuel cells deposited on silica supports

- H01M 2008/1293 . . . {Fuel cells with solid oxide electrolytes}
- H01M 8/14 . Fuel cells with fused electrolytes
- H01M 8/141 . . {the anode and the cathode being gas-permeable electrodes or electrode layers}
- H01M 8/142 . . . {with matrix-supported or semi-solid matrix-reinforced electrolyte}
- H01M 8/143 . . {with liquid, solid or electrolyte-charged reactants}
- H01M 8/144 . . {characterised by the electrolyte material}
- H01M 8/145 . . . {comprising carbonates}
- H01M 8/146 . . {Fuel cells with molten hydroxide (molten hydroxide electrolyte [H01M 2300/006](#))}
- H01M 2008/147 . . {Fuel cells with molten carbonates}
- H01M 8/148 . . {Measures, other than selecting a specific electrode material, to reduce electrode dissolution}
- H01M 8/16 . Biochemical fuel cells, i.e. cells in which micro-organisms function as catalysts
- H01M 8/18 . Regenerative fuel cells
- H01M 8/182 . . {Regeneration by thermal means}
- H01M 8/184 . . {Regeneration by electrochemical means}
- H01M 8/186 . . . {by electrolytic decomposition of the electrolytic solution or the formed water product}
- H01M 8/188 . . . {by recharging of redox couples containing fluids; Redox flow type batteries}
- H01M 8/20 . Indirect fuel cells, e.g. Redox cells ([H01M 8/18](#) takes precedence)
- H01M 8/22 . Fuel cells in which the fuel is based on materials comprising carbon or oxygen or hydrogen and other elements; Fuel cells in which the fuel is based on materials comprising only elements other than carbon, oxygen or hydrogen
- H01M 8/222 . . {Fuel cells in which the fuel is based on compounds containing nitrogen, e.g. hydrazine, ammonia}
- H01M 8/225 . . {Fuel cells in which the fuel is based on materials comprising particulate active material in the form of a suspension, a dispersion, a fluidised bed or a paste}
- H01M 8/227 . . {Dialytic cells or batteries; Reverse electrodialysis cells or batteries}
- H01M 8/24 . Grouping of fuel cells, e.g. stacking of fuel cells

**WARNING**

Group [H01M 8/24](#) is impacted by reclassification into group [H01M 8/2404](#). Groups [H01M 8/24](#) and [H01M 8/2404](#) should be considered in order to perform a complete search.

## H01M 8/2404

- Processes or apparatus for grouping fuel cells

**WARNING**

Group [H01M 8/2404](#) is incomplete pending reclassification of documents from groups [H01M 8/24](#), [H01M 8/241](#), [H01M 8/242](#), [H01M 8/2425](#), [H01M 8/243](#), [H01M 8/2435](#), [H01M 8/244](#), [H01M 8/245](#) and [H01M 8/246](#).

All groups listed in this warning should be considered when searching [H01M 8/2404](#) to perform a complete search.

H01M 8/2405  
(Frozen)

- {comprising spaced diffusion electrodes or electrode layers with interposed electrolyte layer or electrolyte compartment}

**WARNING**

Group [H01M 8/2405](#) is no longer used for the classification of documents as of February 1, 2016. The content of this group is being reclassified into groups [H01M 8/2457](#) and [H01M 8/2459](#).

Group [H01M 8/2405](#) should be considered when searching group [H01M 8/2457](#) or [H01M 8/2459](#) in order to perform a complete search.

## H01M 8/241

- with solid or matrix-supported electrolytes

**WARNING**

Group [H01M 8/241](#) is impacted by reclassification into groups [H01M 8/2404](#) and [H01M 8/2418](#).

Groups [H01M 8/241](#) should be considered when searching group [H01M 8/2404](#) or group [H01M 8/2418](#) in order to perform a complete search.

H01M 8/2415  
(Frozen)

- {External manifolded battery stock}

**WARNING**

Group [H01M 8/2415](#) is no longer used for the classification of documents as of February 1, 2016. The content of this group is being reclassified into groups [H01M 8/2484](#) and [H01M 8/2485](#).

Groups [H01M 8/2415](#) should be considered when searching group [H01M 8/2484](#) or [H01M 8/2485](#) in order to perform a complete search.

## H01M 8/2418

- Grouping by arranging unit cells in a plane ([H01M 8/2425](#), [H01M 8/244](#) take precedence)

**WARNING**

Group [H01M 8/2418](#) is incomplete pending reclassification of documents from group [H01M 8/241](#).

Group [H01M 8/241](#) and [H01M 8/2418](#) should be considered in order to perform a complete search.

- H01M 8/242 . . . comprising framed electrodes or intermediary frame-like gaskets  
([H01M 8/2425](#), [H01M 8/244](#) take precedence)

**WARNING**

Group [H01M 8/242](#) is incomplete pending reclassification of documents from groups [H01M 8/245](#) and [H01M 8/246](#), and impacted by reclassification into groups [H01M 8/2404](#).

Group [H01M 8/242](#), [H01M 8/2404](#), [H01M 8/245](#), and [H01M 8/246](#) should be considered in order to perform a complete search.

- H01M 8/2425 . . . High-temperature cells with solid electrolytes

**WARNING**

Group [H01M 8/2425](#) is incomplete pending reclassification of documents from group [H01M 8/245](#) and [H01M 8/246](#), and impacted by reclassification into groups [H01M 8/2428](#), [H01M 8/2432](#) and [H01M 8/2404](#).

Groups [H01M 8/2425](#), [H01M 8/2428](#), [H01M 8/2432](#), [H01M 8/2404](#), [H01M 8/245](#) and [H01M 8/246](#) should be considered in order to perform a complete search.

- H01M 8/2428 . . . . Grouping by arranging unit cells on a surface of any form, e.g. planar or tubular

**WARNING**

Group [H01M 8/2428](#) is incomplete pending reclassification of documents from groups [H01M 8/2425](#), [H01M 8/245](#) and [H01M 8/246](#).

Groups [H01M 8/2425](#), [H01M 8/245](#), [H01M 8/246](#), and [H01M 8/2428](#) should be considered in order to perform a complete search.

- H01M 8/243 . . . . Grouping of unit cells of tubular or cylindrical configuration

**WARNING**

Group [H01M 8/243](#) is impacted by reclassification into group [H01M 8/2404](#).

Groups [H01M 8/243](#) and [H01M 8/2404](#) should be considered in order to perform a complete search.

- H01M 8/2432 . . . . Grouping of unit cells of planar configuration

**WARNING**

Group [H01M 8/2432](#) is incomplete pending reclassification of documents from groups [H01M 8/2425](#), [H01M 8/245](#) and [H01M 8/246](#).

Groups [H01M 8/2425](#), [H01M 8/245](#), [H01M 8/246](#) and [H01M 8/2432](#) should be considered in order to perform a complete search.

H01M 8/2435

- • • • with monolithic core structure, e.g. honeycombs

**WARNING**

Group [H01M 8/2435](#) is impacted by reclassification into group [H01M 8/2404](#).

Groups [H01M 8/2435](#) and [H01M 8/2404](#) should be considered in order to perform a complete search.

H01M 8/244

- • • with matrix-supported molten electrolyte

**WARNING**

Group [H01M 8/244](#) is/are impacted by reclassification into group [H01M 8/2404](#).

Groups [H01M 8/244](#) and [H01M 8/2404](#) should be considered in order to perform a complete search.

H01M 8/2445  
(Frozen)

- • {comprising spaced diffusion electrodes or electrode layers with interposed electrolyte compartment with possible electrolyte supply or circulation}

**WARNING**

Group [H01M 8/2445](#) is no longer used for the classification of documents as of February 1, 2016. The content of this group is being reclassified into groups [H01M 8/2457](#) and [H01M 8/2459](#).

Groups [H01M 8/2445](#) should be considered when searching group [H01M 8/2457](#) or [H01M 8/2459](#) in order to perform a complete search.

H01M 8/245  
(Frozen)

- • • {comprising framed electrodes or intermediary frame-like gaskets}

**WARNING**

Group [H01M 8/245](#) is no longer used for the classification of documents as of February 1, 2016. The content of this group is being reclassified into groups [H01M 8/2404](#), [H01M 8/2428](#), [H01M 8/2432](#), [H01M 8/242](#) and [H01M 8/2425](#).

Groups [H01M 8/245](#) should be considered when searching any of the listed groups of this warning in order to perform a complete search.

H01M 8/2455

- • with liquid, solid or electrolyte-charged reactants

H01M 8/2457

- • with both reactants being gaseous or vaporised

**WARNING**

Group [H01M 8/2457](#) is incomplete & pending reclassification of documents from groups [H01M 8/2405](#) and [H01M 8/2445](#).

Groups [H01M 8/2405](#), [H01M 8/2445](#) and [H01M 8/2457](#) should be considered in order to perform a complete search.

H01M 8/2459

- . . {Comprising electrode layers with interposed electrolyte compartment with possible electrolyte supply or circulation}

**WARNING**

Group [H01M 8/2459](#) is/are incomplete pending reclassification of documents from groups [H01M 8/2405](#) and [H01M 8/2445](#).

Groups [H01M 8/2405](#), [H01M 8/2445](#) and [H01M 8/2459](#) should be considered in order to perform a complete search.

H01M 8/246  
(Frozen)

- . . {having liquid, solid or electrolyte-charged reactants with framed electrodes or intermediary frame-like gaskets}

**WARNING**

Group [H01M 8/246](#) is no longer used for the classification of documents as of February 1, 2016. The content of this group is being reclassified into groups [H01M 8/2404](#), [H01M 8/2428](#), [H01M 8/2432](#), [H01M 8/242](#) and [H01M 8/2425](#).

Groups [H01M 8/246](#) should be considered when searching any of the listed groups of this warning in order to perform a complete search.

H01M 8/2465

- . . Details of groupings of fuel cells

**WARNING**

Group [H01M 8/2465](#) is impacted by reclassification into group [H01M 8/2483](#).

Groups [H01M 8/2465](#) and [H01M 8/2483](#) should be considered in order to perform a complete search.

H01M 8/247

- . . . Arrangements for tightening a stack, for accommodation of a stack in a tank or for assembling different tanks

H01M 8/2475

- . . . . Enclosures, casings or containers of fuel cell stacks

H01M 8/248

- . . . . Means for compression of the fuel cell stacks

H01M 8/2483

- . . . characterised by internal manifolds

**WARNING**

Group [H01M 8/2483](#) is incomplete pending reclassification of documents from groups [H01M 8/0258](#) and [H01M 8/2465](#).

Groups [H01M 8/0258](#), [H01M 8/2465](#) and [H01M 8/2483](#) should be considered in order to perform a complete search.

H01M 8/2484

- . . . characterised by external manifolds

**WARNING**

Group [H01M 8/2484](#) is incomplete pending reclassification of documents from groups [H01M 8/2415](#) and [H01M 8/2485](#).

Groups [H01M 8/2415](#), [H01M 8/2485](#) and [H01M 8/2484](#) should be considered in order to perform a complete search.



- H01M 8/2485 . . . . Arrangements for sealing external manifolds; Arrangements for mounting external manifolds around a stack

**WARNING**

Group [H01M 8/2485](#) is incomplete pending reclassification of documents from group [H01M 8/2415](#) and impacted by reclassification into group [H01M 8/2484](#).

Groups [H01M 8/2415](#), [H01M 8/2485](#) and [H01M 8/2484](#) should be considered in order to perform a complete search.

- H01M 8/249 . . comprising two or more groupings of fuel cells, e.g. modular assemblies

- H01M 8/2495 . . . of fuel cells of different types

**H01M 10/00****Secondary cells; Manufacture thereof****NOTE**

Secondary cells are accumulators receiving and supplying electrical energy by means of reversible electrochemical reactions.

- H01M 10/02 . Details (of non-active parts [H01M 2/00](#); of electrodes [H01M 4/00](#))
- H01M 10/04 . Construction or manufacture in general ([H01M 10/12](#), [H01M 10/28](#), [H01M 10/38](#) take precedence)
- H01M 10/0404 . . {Machines for assembling batteries}
- H01M 10/0409 . . . {for cells with wound electrodes}
- H01M 10/0413 . . {Large-sized flat cells or batteries for motive or stationary systems with plate-like electrodes}
- H01M 10/0418 . . . {with bipolar electrodes}
- H01M 10/0422 . . {Cells or battery with cylindrical casing}
- H01M 10/0427 . . . {Button cells}
- H01M 10/0431 . . {Cells with wound or folded electrodes ([H01M 10/045](#) takes precedence)}
- H01M 10/0436 . . {Small-sized flat cells or batteries portable equipment}
- H01M 10/044 . . . {with bipolar electrodes}
- H01M 10/0445 . . {Multimode batteries, e.g. containing auxiliary cells or electrodes switchable in parallel or series connections}
- H01M 10/045 . . {Cells or batteries with folded plate-like electrodes}
- H01M 10/0454 . . . {Cells or batteries with electrodes of only one polarity folded}
- H01M 10/0459 . . {Cells or batteries with folded separator between plate-like electrodes}
- H01M 10/0463 . . {Cells or batteries with horizontal or inclined electrodes}
- H01M 10/0468 . . {Compression means for stacks of electrodes and separators}
- H01M 10/0472 . . {Vertically superposed cells with vertically disposed plates}
- H01M 10/0477 . . {with circular plates}
- H01M 10/0481 . . {Compression means other than compression means for stacks of electrodes and separators}
- H01M 10/0486 . . {Frames for plates or membranes}
- H01M 10/049 . . {Processes for forming or storing electrodes in the battery container}
- H01M 2010/0495 . . {Nanobatteries}

- H01M 10/05 . Accumulators with non-aqueous electrolyte ([H01M 10/39 takes precedence](#))
- H01M 10/052 . . Li-accumulators
- H01M 10/0525 . . . Rocking-chair batteries, i.e. batteries with lithium insertion or intercalation in both electrodes; Lithium-ion batteries
- H01M 10/054 . . Accumulators with insertion or intercalation of metals other than lithium, e.g. with magnesium or aluminium
- H01M 10/056 . . characterised by the materials used as electrolytes, e.g. mixed inorganic/organic electrolytes {(electrolytes for hybrid or electric double layer capacitors [H01G 11/54](#))}
- H01M 10/0561 . . . the electrolyte being constituted of inorganic materials only
- H01M 10/0562 . . . . Solid materials
- H01M 10/0563 . . . . Liquid materials, e.g. for Li-SOCl<sub>2</sub> cells
- H01M 10/0564 . . . the electrolyte being constituted of organic materials only
- H01M 10/0565 . . . . Polymeric materials, e.g. gel-type or solid-type
- H01M 10/0566 . . . . Liquid materials
- H01M 10/0567 . . . . . characterised by the additives
- H01M 10/0568 . . . . . characterised by the solutes
- H01M 10/0569 . . . . . characterised by the solvents
- H01M 10/058 . . Construction or manufacture
- H01M 10/0583 . . . of accumulators with folded construction elements except wound ones, i.e. folded positive or negative electrodes or separators, e.g. with "Z"-shaped electrodes or separators
- H01M 10/0585 . . . of accumulators having only flat construction elements, i.e. flat positive electrodes, flat negative electrodes and flat separators
- H01M 10/0587 . . . of accumulators having only wound construction elements, i.e. wound positive electrodes, wound negative electrodes and wound separators
- H01M 10/06 . Lead-acid accumulators ([semi-lead accumulators H01M 10/20](#))
- H01M 10/08 . . Selection of materials as electrolytes
- H01M 10/10 . . . Immobilising of electrolyte
- H01M 10/12 . . Construction or manufacture
- H01M 10/121 . . . {Valve regulated lead acid batteries [VRLA]}
- H01M 10/122 . . . {Multimode batteries}
- H01M 10/123 . . . {Cells or batteries with cylindrical casing}
- H01M 10/124 . . . . {Button cells}
- H01M 10/125 . . . {Cells or batteries with wound or folded electrodes}
- H01M 10/126 . . . {Small-sized flat cells or batteries for portable equipment ([H01M 10/123 and H01M 10/125 take precedence](#))}
- H01M 10/127 . . . . {with bipolar electrodes}
- H01M 10/128 . . . {Processes for forming or storing electrodes in the battery container}
- H01M 10/14 . . . Assembling a group of electrodes or separators
- H01M 10/16 . . . Suspending or supporting electrodes or groups of electrodes in the case
- H01M 10/18 . . with bipolar electrodes

- H01M 10/20 . Semi-lead accumulators, i.e. accumulators in which only one electrode contains lead
- H01M 10/22 . . Selection of materials as electrolytes
- H01M 10/24 . Alkaline accumulators
- H01M 10/26 . . Selection of materials as electrolytes
- H01M 10/28 . . Construction or manufacture
- H01M 10/281 . . . {Large cells or batteries with stacks of plate-like electrodes}
- H01M 10/282 . . . . {with bipolar electrodes}
- H01M 10/283 . . . {Cells or batteries with two cup-shaped or cylindrical collectors ([H01M 10/281 takes precedence](#))}
- H01M 10/285 . . . . {Button cells}
- H01M 10/286 . . . {Cells or batteries with wound or folded electrodes}
- H01M 10/287 . . . {Small-sized flat cells or batteries for portable equipment ([H01M 10/283 and H01M 10/286 take precedence](#))}
- H01M 10/288 . . . {Processes for forming or storing electrodes in the battery container}
- H01M 10/30 . . Nickel accumulators ([H01M 10/34 takes precedence](#))
- H01M 10/32 . . Silver accumulators ([H01M 10/34 takes precedence](#))
- H01M 10/34 . Gastight accumulators
- H01M 10/342 . . {Gastight lead accumulators ([H01M 10/121 takes precedence](#))}
- H01M 10/345 . . {Gastight metal hydride accumulators}
- H01M 10/347 . . . {with solid electrolyte}
- H01M 10/36 . Accumulators not provided for in groups [H01M 10/05-H01M 10/34](#)
- H01M 10/365 . . {Zinc-halogen accumulators}
- H01M 10/38 . . Construction or manufacture
- H01M 10/39 . . Working at high temperature
- H01M 10/3909 . . . {Sodium-sulfur cells}
- H01M 10/3918 . . . . {characterised by the electrolyte}
- H01M 10/3927 . . . . . {Several layers of electrolyte or coatings containing electrolyte}
- H01M 10/3936 . . . . . {Electrolyte with a shape other than plane or cylindrical}
- H01M 10/3945 . . . . {containing additives or special arrangements in the sodium compartment}
- H01M 10/3954 . . . . {containing additives or special arrangement in the sulfur compartment}
- H01M 10/3963 . . . . {Sealing means between the solid electrolyte and holders}
- H01M 10/3972 . . . . {Flexible parts}
- H01M 10/3981 . . . . {Flat cells}
- H01M 10/399 . . . {Cells with molten salts}
- H01M 10/42 . Methods or arrangements for servicing or maintenance of secondary cells or secondary half-cells ([H01M 10/60 takes precedence](#))
- H01M 10/4207 . . {for several batteries or cells simultaneously or sequentially}
- H01M 10/4214 . . {Arrangements for moving electrodes or electrolyte}
- H01M 10/4221 . . {with battery type recognition}

- H01M 10/4228 . . {Leak testing of cells or batteries}
- H01M 10/4235 . . {Safety or regulating additives or arrangements in electrodes, separators or electrolyte ([H01M 10/4242](#) takes precedence)}
- H01M 10/4242 . . {Regeneration of electrolyte or reactants}
- H01M 10/425 . . {Structural combination with electronic components, e.g. electronic circuits integrated to the outside of the casing ([printed circuits H05K 1/00](#))}
- H01M 10/4257 . . . {Smart batteries, e.g. electronic circuits inside the housing of the cells or batteries}
- H01M 10/4264 . . . {with capacitors}
- H01M 2010/4271 . . . {Battery management systems including electronic circuits, e.g. control of current or voltage to keep battery in healthy state, cell balancing}
- H01M 2010/4278 . . . {Systems for data transfer from batteries, e.g. transfer of battery parameters to a controller, data transferred between battery controller and main controller}
- H01M 10/4285 . . {Testing apparatus}
- H01M 2010/4292 . . {Aspects relating to capacity ratio of electrodes/electrolyte or anode/cathode}
- H01M 10/44 . . Methods for charging or discharging ([circuits for charging H02J 7/00](#))
- H01M 10/441 . . . {for several batteries or cells simultaneously or sequentially}
- H01M 10/443 . . . {in response to temperature}
- H01M 10/445 . . . {in response to gas pressure}
- H01M 10/446 . . . {Initial charging measures}
- H01M 10/448 . . . {End of discharge regulating measures}
- H01M 10/46 . . Accumulators structurally combined with charging apparatus ([circuits for charging H02J 7/00](#))
- H01M 10/465 . . . {with solar battery as charging system}
- H01M 10/48 . . Accumulators combined with arrangements for measuring, testing or indicating condition, e.g. level or density of the electrolyte ([H01M 10/44](#) takes precedence); indicating or measuring level of liquid in general [G01F 23/00](#); measuring density [G01N](#), e.g. [G01N 9/00](#); measuring electric variables [G01R](#))
- H01M 10/482 . . . {for several batteries or cells simultaneously or sequentially}
- H01M 10/484 . . . {for measuring electrolyte level, electrolyte density or electrolyte conductivity}
- H01M 10/486 . . . {for measuring temperature}
- H01M 10/488 . . . {Cells or batteries combined with indicating means for externally visualisation of the condition, e.g. by change of colour or of light intensity}
- H01M 10/52 . . Removing gases inside the secondary cell, e.g. by absorption ([vent plugs or other mechanical arrangements for facilitating escape of gases H01M 2/12](#))
- H01M 10/523 . . . {by recombination on a catalytic material}
- H01M 10/526 . . . {by gas recombination on the electrode surface or by structuring the electrode surface to improve gas recombination}
- H01M 10/54 . . Reclaiming serviceable parts of waste accumulators
- H01M 10/60 . . Heating or cooling; Temperature control
- H01M 10/61 . . Types of temperature control

- H01M 10/613 . . . Cooling or keeping cold
- H01M 10/615 . . . Heating or keeping warm
- H01M 10/617 . . . for achieving uniformity or desired distribution of temperature
- H01M 10/62 . . specially adapted for specific applications
- H01M 10/623 . . . Portable devices, e.g. mobile telephones, cameras or pacemakers
- H01M 10/6235 . . . . Power tools
- H01M 10/625 . . . Vehicles
- H01M 10/627 . . . Stationary installations, e.g. power plant buffering or backup power supplies
- H01M 10/63 . . Control systems ([measurement of temperature H01M 10/486](#); [charging or discharging in response to temperature H01M 10/443](#))
- H01M 10/633 . . . characterised by algorithms, flow charts, software details or the like
- H01M 10/635 . . . based on ambient temperature
- H01M 10/637 . . . characterised by the use of reversible temperature-sensitive devices, e.g. NTC, PTC or bimetal devices; characterised by control of the internal current flowing through the cells, e.g. by switching ([H01M 2/34 takes precedence](#))
- H01M 10/64 . . characterised by the shape of the cells
- H01M 10/643 . . . Cylindrical cells
- H01M 10/647 . . . Prismatic or flat cells, e.g. pouch cells
- H01M 10/65 . . Means for temperature control structurally associated with the cells
- H01M 10/651 . . . characterised by parameters specified by a numeric value or mathematical formula, e.g. ratios, sizes or concentrations
- H01M 10/652 . . . . characterised by gradients ([for achieving a desired temperature gradient H01M 10/617](#))
- H01M 10/653 . . . characterised by electrically insulating or thermally conductive materials
- H01M 10/654 . . . located inside the innermost case of the cells, e.g. mandrels, electrodes or electrolytes
- H01M 10/655 . . . Solid structures for heat exchange or heat conduction
- H01M 10/6551 . . . . Surfaces specially adapted for heat dissipation or radiation, e.g. fins or coatings
- H01M 10/6552 . . . . Closed pipes transferring heat by thermal conductivity or phase transition, e.g. heat pipes
- H01M 10/6553 . . . . Terminals or leads
- H01M 10/6554 . . . . Rods or plates
- H01M 10/6555 . . . . . arranged between the cells
- H01M 10/6556 . . . . Solid parts with flow channel passages or pipes for heat exchange ([closed pipes H01M 10/6552](#))
- H01M 10/6557 . . . . . arranged between the cells
- H01M 10/656 . . . characterised by the type of heat-exchange fluid
- H01M 10/6561 . . . . Gases
- H01M 10/6562 . . . . . with free flow by convection only
- H01M 10/6563 . . . . . with forced flow, e.g. by blowers

- H01M 10/6564 . . . . . using compressed gas
- H01M 10/6565 . . . . . with recirculation or U-turn in the flow path, i.e. back and forth
- H01M 10/6566 . . . . . Means within the gas flow to guide the flow around one or more cells, e.g. manifolds, baffles or other barriers ([H01M 10/6565 takes precedence](#))
- H01M 10/6567 . . . . . Liquids
- H01M 10/6568 . . . . . characterised by flow circuits, e.g. loops, located externally to the cells or cell casings
- H01M 10/6569 . . . . . Fluids undergoing a liquid-gas phase change or transition, e.g. evaporation or condensation ([heat pipes H01M 10/6552](#))
- H01M 10/657 . . . . . by electric or electromagnetic means
- H01M 10/6571 . . . . . Resistive heaters ([arrangements for heating the battery by its resistance to the internal current H01M 10/637](#))
- H01M 10/6572 . . . . . Peltier elements or thermoelectric devices
- H01M 10/658 . . . . . by thermal insulation or shielding
- H01M 10/659 . . . . . by heat storage or buffering, e.g. heat capacity or liquid-solid phase changes or transition
- H01M 10/6595 . . . . . by chemical reactions other than electrochemical reactions of the cells, e.g. catalytic heaters or burners
- H01M 10/66 . . . . . Heat-exchange relationships between the cells and other systems, e.g. central heating systems or fuel cells
- H01M 10/663 . . . . . the system being an air-conditioner or an engine
- H01M 10/667 . . . . . the system being an electronic component, e.g. a CPU, an inverter or a capacitor

## **H01M 12/00 Hybrid cells; Manufacture thereof**

### **NOTE**

Hybrid cells are 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 12/005 . {composed of a half-cell of the capacitor type and of a half-cell of the primary or secondary battery type ([hybrid capacitors H01G 9/155](#))}
- H01M 12/02 . Details ([of non-active parts H01M 2/00](#); [of electrodes H01M 4/00](#))
- H01M 12/04 . composed of a half-cell of the fuel-cell type and of a half-cell of the primary-cell type ([methods or arrangements for servicing or maintenance H01M 6/50](#))
- H01M 12/06 . . with one metallic and one gaseous electrode
- H01M 12/065 . . . {with plate-like electrodes or stacks of plate-like electrodes}
- H01M 12/08 . composed of a half-cell of a fuel-cell type and a half-cell of the secondary-cell type ([methods or arrangements for servicing or maintenance, e.g. for charging, H01M 10/42](#))
- H01M 12/085 . . {Zinc-halogen cells or batteries}

## **H01M 14/00 Electrochemical current or voltage generators not provided for in groups [H01M 6/00](#) - [H01M 12/00](#); Manufacture thereof**

H01M 14/005	<ul style="list-style-type: none"> <li>• {Photoelectrochemical storage cells (light sensitive devices <a href="#">H01G 9/20</a>, semiconductors sensitive to light <a href="#">H01L 31/00</a>)}</li> </ul>
<b>H01M 16/00</b>	<b>Structural combinations of different types of electrochemical generators</b>
H01M 16/003	<ul style="list-style-type: none"> <li>• {of fuel cells with other electrochemical devices, e.g. capacitors, electrolyzers}</li> </ul>
H01M 16/006	<ul style="list-style-type: none"> <li>• . {of fuel cells with rechargeable batteries}</li> </ul>
<b>H01M 2200/00</b>	<b>Safety devices for primary or secondary batteries</b>
H01M 2200/10	<ul style="list-style-type: none"> <li>• Temperature sensitive devices</li> </ul>
H01M 2200/101	<ul style="list-style-type: none"> <li>• . Bimetal</li> </ul>
H01M 2200/103	<ul style="list-style-type: none"> <li>• . Fuse</li> </ul>
H01M 2200/105	<ul style="list-style-type: none"> <li>• . NTC</li> </ul>
H01M 2200/106	<ul style="list-style-type: none"> <li>• . PTC</li> </ul>
H01M 2200/108	<ul style="list-style-type: none"> <li>• . Normal resistors</li> </ul>
H01M 2200/20	<ul style="list-style-type: none"> <li>• Pressure-sensitive devices</li> </ul>
H01M 2200/30	<ul style="list-style-type: none"> <li>• Preventing polarity reversal</li> </ul>
<b>H01M 2220/00</b>	<b>Batteries for particular applications</b>
H01M 2220/10	<ul style="list-style-type: none"> <li>• Batteries in stationary systems, e.g. emergency power source in plant</li> </ul>
H01M 2220/20	<ul style="list-style-type: none"> <li>• Batteries in motive systems, e.g. vehicle, ship, plane</li> </ul>
H01M 2220/30	<ul style="list-style-type: none"> <li>• Batteries in portable systems, e.g. mobile phone, laptop</li> </ul>
<b>H01M 2250/00</b>	<b>Fuel cells for particular applications; Specific features of fuel cell system</b>
H01M 2250/10	<ul style="list-style-type: none"> <li>• Fuel cells in stationary systems, e.g. emergency power source in plant</li> </ul>
H01M 2250/20	<ul style="list-style-type: none"> <li>• Fuel cells in motive systems, e.g. vehicle, ship, plane</li> </ul>
H01M 2250/30	<ul style="list-style-type: none"> <li>• Fuel cells in portable systems, e.g. mobile phone, laptop</li> </ul>
H01M 2250/40	<ul style="list-style-type: none"> <li>• Combination of fuel cells with other energy production systems</li> </ul>
H01M 2250/402	<ul style="list-style-type: none"> <li>• . Combination of fuel cell with other electric generators (<a href="#">combination of fuel cells with other electrochemical generator H01M 16/003</a>)</li> </ul>
H01M 2250/405	<ul style="list-style-type: none"> <li>• . Cogeneration of heat or hot water</li> </ul>
H01M 2250/407	<ul style="list-style-type: none"> <li>• . Combination of fuel cells with mechanical energy generators</li> </ul>
<b>H01M 2300/00</b>	<b>Electrolytes</b>
H01M 2300/0002	<ul style="list-style-type: none"> <li>• Aqueous electrolytes</li> </ul>
H01M 2300/0005	<ul style="list-style-type: none"> <li>• . Acid electrolytes</li> </ul>
H01M 2300/0008	<ul style="list-style-type: none"> <li>• . . Phosphoric acid-based</li> </ul>
H01M 2300/0011	<ul style="list-style-type: none"> <li>• . . Sulfuric acid-based</li> </ul>
H01M 2300/0014	<ul style="list-style-type: none"> <li>• . Alkaline electrolytes</li> </ul>
H01M 2300/0017	<ul style="list-style-type: none"> <li>• Non-aqueous electrolytes</li> </ul>
H01M 2300/002	<ul style="list-style-type: none"> <li>• . Inorganic electrolyte</li> </ul>
H01M 2300/0022	<ul style="list-style-type: none"> <li>• . . Room temperature molten salts</li> </ul>
H01M 2300/0025	<ul style="list-style-type: none"> <li>• . Organic electrolyte</li> </ul>

H01M 2300/0028	. . .	characterised by the solvent
H01M 2300/0031	. . . .	Chlorinated solvents
H01M 2300/0034	. . . .	Fluorinated solvents
H01M 2300/0037	. . . .	Mixture of solvents
H01M 2300/004	. . . . .	Three solvents
H01M 2300/0042	. . . . .	Four or more solvents
H01M 2300/0045	. . .	Room temperature molten salts comprising at least one organic ion
H01M 2300/0048	. .	Molten electrolytes used at high temperature
H01M 2300/0051	. . .	Carbonates
H01M 2300/0054	. . .	Halogenides
H01M 2300/0057	. . . .	Chlorides
H01M 2300/006	. . .	Hydroxides
H01M 2300/0062	. . .	Nitrates
H01M 2300/0065	. .	Solid electrolytes
H01M 2300/0068	. . .	inorganic
H01M 2300/0071	. . . .	Oxides
H01M 2300/0074	. . . . .	Ion conductive at high temperature
H01M 2300/0077	. . . . .	based on zirconium oxide
H01M 2300/008	. . . .	Halides
H01M 2300/0082	. . .	Organic polymers
H01M 2300/0085	. .	Immobilising or gelification of electrolyte
H01M 2300/0088	. .	Composites
H01M 2300/0091	. .	in the form of mixtures
H01M 2300/0094	. .	in the form of layered products, e.g. coatings
H01M 2300/0097	. . .	with adhesive layers