

**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 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 }

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| 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 ( <a href="#">H01M 2/029</a> 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 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 ( <a href="#">H01M 2/0443</a> 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 ( <a href="#">H01M 2/0417</a> 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 ( <a href="#">H01M 2/0443</a> 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 4/04 . . . Processes of manufacture in general
- H01M 4/0402 . . . { Methods of deposition of the material }
- H01M 4/0404 . . . . { by coating on electrode collectors }

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| 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<br>( <a href="#">H01M 4/0438</a> 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 ( <a href="#">electroless electrochemical plating C23C 18/54</a> ) }                            |
| H01M 4/044  | ....  | { Activating, forming or electrochemical attack of the supporting material }  |
| H01M 4/0442 | ..... | { Anodisation, Oxidation ( <a href="#">electrolytic coating by anodisation C25D 9/00</a> ) }                                    |
| 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 ( <a href="#">H01M 4/0438</a> , 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 }   |

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| 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 <a href="#">H01M 4/38</a> )       |
| H01M 4/13   | ..   | Electrodes for accumulators with non-aqueous electrolyte, e.g. for lithium-accumulators; Processes of manufacture thereof |

**NOTE**

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](#)

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| 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 {<br>( <a href="#">electrode materials of hybrid or double layer capacitors</a><br><a href="#">H01G 11/30-H01G 11/50</a> ) } |
| 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 ( <a href="#">H01M 4/40</a> takes precedence ) }   |
| H01M 4/382 | ..... | { Lithium ( <a href="#">H01M 4/405</a> takes precedence ) }   |
| H01M 4/383 | ....  | { Hydrogen absorbing alloys }   |
| H01M 4/385 | ..... | { of the type LaNi5 }   |
| 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 ( <a href="#">H01M 4/485</a> takes precedence ) }   |
| H01M 4/485 | ....  | of mixed oxides or hydroxides for inserting or intercalating light metals, e.g. LiTi2O4 or LiTi2OxFy ( <a href="#">H01M 4/505</a> , <a href="#">H01M 4/525</a> take precedence )                        |
| H01M 4/50  | ....  | of manganese  |
| H01M 4/502 | ..... | { for non-aqueous cells ( <a href="#">H01M 4/505</a> takes precedence ) }   |
| H01M 4/505 | ..... | of mixed oxides or hydroxides containing manganese for inserting or intercalating light metals, e.g. LiMn2O4 or LiMn2OxFy   |
| H01M 4/52  | ....  | of nickel, cobalt or iron   |
| H01M 4/521 | ..... | { of iron for aqueous cells }   |
| H01M 4/523 | ..... | { for non-aqueous cells ( <a href="#">H01M 4/525</a> takes precedence ) }   |
| H01M 4/525 | ..... | of mixed oxides or hydroxides containing iron, cobalt or nickel for inserting or intercalating light metals, e.g. LiNiO2, LiCoO2 or 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 LiCoFy |
| 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

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| H01M 4/583  | ....  | Carbonaceous material, e.g. graphite-intercalation compounds or CFx  |
| 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 { ( <a href="#">current collector for hybrid or electric double layer capacitors H01G 11/66</a> ) } |
| H01M 4/66   | ...   | Selection of materials   |
| H01M 4/661  | ....  | { Metal or alloys, e.g. alloy coatings ( <a href="#">H01M 4/669 take precedence</a> ) }                                    |
| H01M 4/662  | ..... | { Alloys ( <a href="#">collectors of lead alloys H01M 4/685</a> ) }  |
| 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 ( <a href="#">H01M 4/668 takes precedence</a> ) }   |
| 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<br>( 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 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 ) } |

**WARNING**

Groups [H01M 4/8803](#) to [H01M 4/8896](#) are not complete, pending a reorganization. See also [H01M 4/88](#), [H01M 4/88E](#), [H01M 8/10B2A](#) and [H01M 8/1006](#)

|             |       |   |
|-------------|-------|---|
| 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 ( coated porous composites <a href="#">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 <a href="#">H01M 8/1004</a> ) }  |
| 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 6/12 . . . with flat electrodes
- H01M 6/14 . Cells with non-aqueous electrolyte { [H01M 10/36C](#) takes precedence }

- H01M 6/145 . . { containing ammonia }
- H01M 6/16 . . with organic electrolyte ( [H01M 6/18](#) , { [H01M 10/40](#) 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 . . . [N: 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](#), [H01M 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 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      .      { Destruction or recycling of fuel cells }
  
- H01M 8/02      .      Details
- H01M 8/0202      ..      { Collectors, separators, interconnectors, e.g. bipolar separators }
- 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-tight carbon-containing material }
- H01M 8/0215      ....      { Glass or ceramic materials }
- H01M 8/0217      .....      { Complexed oxides, optionally doped, of the type  $M_1MeO_3$ ,  $M_1$  being an  
alkaline earth metal or rare earth metal, Me being a metal, e.g.  
perovskites }

|             |       |   |
|-------------|-------|---|
| H01M 8/0219 | ..... | { Chromium complex oxides }   |
| H01M 8/0221 | ....  | { Polymers or organic resins }  |
| H01M 8/0223 | ....  | { Composites }  |
| H01M 8/0226 | ..... | { in the form of mixtures }   |
| H01M 8/0228 | ..... | { in the form of layered products, e.g. coatings }  |
| 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 or cermets }  |
| H01M 8/0239 | ....  | { Polymers or organic resins }  |
| H01M 8/0241 | ....  | { Composites }  |
| H01M 8/0243 | ..... | { in the form of mixtures }   |
| H01M 8/0245 | ..... | { in the form of layered products, e.g. coatings }  |
| H01M 8/0247 | ...   | { Porous or non porous and characterised by the form ( characterised by a channel configuration <a href="#">H01M 8/0258</a> ) } |
| H01M 8/025  | ....  | { Semicylindrical }   |
| H01M 8/0252 | ....  | { Tubular }   |
| H01M 8/0254 | ....  | { Corrugated or undulate shaped }   |
| H01M 8/0256 | ....  | { Vias, i.e. connector passing through the separator material }   |
| H01M 8/0258 | ...   | { Porous or non-porous and characterised by a channel configuration, i.e. by the flow field }                                   |
| H01M 8/026  | ....  | { Grooves characteristics, pitch, depth }   |
| H01M 8/0263 | ....  | { Meander or serpentine path }  |
| H01M 8/0265 | ....  | { Variable section of reactant channel }  |
| H01M 8/0267 | ...   | { Heating or cooling facilities in the separators, collectors or interconnectors }  |
| H01M 8/0269 | ...   | { Separators, collectors or interconnectors including a printed circuit board }   |
| H01M 8/0271 | ..    | { of surrounding electrodes, matrices, membranes or fuel cell elements with sealing or supporting material }                    |
| H01M 8/0273 | ...   | { in the form of a frame; Frame materials; Way of attaching to frames }   |
| H01M 8/0276 | ...   | { Seals characterised by their form }   |
| H01M 8/0278 | ....  | { O-rings }   |
| H01M 8/028  | ...   | { Seals characterised by their composition }  |
| H01M 8/0282 | ....  | { Inorganic material }  |
| H01M 8/0284 | ....  | { Organic resins or polymers }  |
| H01M 8/0286 | ...   | { Process of seal formation }   |
| H01M 8/0289 | ..    | { of membranes or electrolyte holding means }   |
| H01M 8/0291 | ...   | { Matrices; Diaphragms; Membranes }   |
| H01M 8/0293 | ....  | { for immobilising electrolyte solutions }  |
| H01M 8/0295 | ....  | { for immobilising electrolyte melts }  |
| H01M 8/0297 | ..    | { of joining electrodes, reservoir layers, heat exchange units or bipolar separators to each other }                            |
| H01M 8/04   | .     | Auxiliary arrangements or processes, e.g. for control of pressure, for circulation of fluids                                    |



|              |       |   |
|--------------|-------|---|
| H01M 8/04007 | ..    | { Arrangements or means or processes related to heat exchange or temperature measurements ( methods for controlling fuel cells or fuel cell systems <a href="#">H01M 8/04298</a> ) }  |
| H01M 8/04014 | ...   | { by a gaseous fluid or by combustion of reactants, e.g. bigascooling }   |
| H01M 8/04022 | ....  | { Heating by combustion }   |
| H01M 8/04029 | ...   | { by a liquid fluid }   |
| H01M 8/04037 | ...   | { Electrical heating }  |
| H01M 8/04044 | ...   | { Coolant purification }  |
| 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 <a href="#">F28</a> , heat exchangers for fuel cells <a href="#">F28D 2021/0043</a> ) }              |
| H01M 8/04082 | ..    | { Arrangements or means for reactant regulation. E.g. pressure or concentration }   |
| H01M 8/04089 | ...   | { of gaseous reactants }  |
| H01M 8/04097 | ....  | { with recycling of the reactants ( <a href="#">H01M 8/04119</a> , <a href="#">H01M 8/04104</a> 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- or electrolyte-charged reactants }   |
| H01M 8/04194 | ....  | { Concentration measuring cells }   |
| 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 | ...   | { Arrangements or means particularly during start-up or shut-down; Depolarisation or activation treatment, e.g. purging; Short-circuiting means for defective fuel cells }            |
| 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 <a href="#">H01M 8/04664</a> , methods for shunting fuel cells <a href="#">H01M 8/04955</a> ) } |
| H01M 8/04253 | ....  | { Means for solving freezing problems }   |
| H01M 8/04261 | ....  | { Preventing means for fuel crossover }   |

|              |       |   |
|--------------|-------|---|
| H01M 8/04268 | ....  | { Heating of fuel cells during the start-up of the fuel cells }   |
| H01M 8/04276 | ..    | { Arrangements or means related to the management of the electrolyte stream, e.g. heat exchange ( <a href="#">H01M 8/04119</a> takes precedence; Treatment of electrolyte residue <a href="#">H01M 8/0693</a> ) } |
| H01M 8/04283 | ...   | { Supply means of electrolyte to or in matrix-fuel cells }  |
| H01M 8/04291 | ..    | { Electrolyte- or water-management of solid electrolyte cells ( <a href="#">H01M 8/04119</a> takes precedence ) }   |
| H01M 8/04298 | ..    | { Methods for controlling fuel cells or fuel cell systems ( means for control <a href="#">H01M 8/04007</a> to <a href="#">H01M 8/04291</a> ) }  |
| H01M 8/04305 | ...   | { Modelling, demonstration models of fuel cells, e.g. for training purposes }   |
| H01M 8/04313 | ...   | { characterised by variables to be detected or calculated, failure or abnormal functionality of the system }  |
| H01M 8/0432  | ....  | { Temperature including 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 or flow including ambient pressure }   |
| 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  | ....  | { Concentrations or densities }   |
| 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, moisture or water content including ambient humidity }  |
| 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 functionality }                       |
| 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 regulated }              |
| 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 or 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 | ....  | { Concentrations or densities }                             |
| 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, moisture or 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 8/04955 | ..... | { Turning on/off, shunting of fuel cells or fuel cell system components<br>( arrangements or means during start-up or shut-down<br><a href="#">H01M 8/04223</a> ) }  |
| H01M 8/04962 | ..... | { Other electric variables e.g. resistance or impedance }  |
| H01M 8/0497  | ..... | { of the individual fuel cell }  |
| H01M 8/04977 | ..... | { of fuel cell stacks }  |
| H01M 8/04985 | ..... | { of auxiliary devices, e.g. batteries, capacitors }   |
| H01M 8/04992 | ...   | { characterised by the implementation of the control method by mathematical or<br>computational algorithm, e.g. control feedback loop mechanisms, fuzzy logic,<br>neural networks, artificial intelligence } |
| H01M 8/06    | .     | Combination of fuel cell with means for production of reactants or for treatment of<br>residues  |
| H01M 8/0606  | ..    | { Producing gaseous reactants }  |
| H01M 8/0612  | ...   | { from carbon containing material }  |
| H01M 8/0618  | ....  | { Reforming processes, e.g. autothermal, partial oxidation or steam<br>reforming }   |
| H01M 8/0625  | ....  | { in a modular combined reactor/fuel cell structure }  |
| H01M 8/0631  | ..... | { Reactor construction specially adapted for combination reactor/fuel cell<br>( <a href="#">Hydrogen C01B 3/00</a> , <a href="#">reactors for physicochemical processes<br/>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 or by dehydrating metallic substance }  |
| H01M 8/0656  | ...   | { by electrochemical means ( <a href="#">H01M 8/065</a> takes precedence ) }   |
| H01M 8/0662  | ..    | { Treatment of gaseous reactants or gaseous residues, e.g. cleaning ( humidifying<br>or dehumidifying of gaseous reactants <a href="#">H01M 8/04119</a> ) }  |
| 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 8/1002 .. { with anode and cathode gas-diffusion electrodes or electrode layers, e.g. using gaseous or vaporised reactants ( [H01M 8/12](#) takes precedence ) }
- H01M 8/1004 ... { characterised by the electrode/electrolyte combination }
- H01M 8/1006 .... { Undulated, corrugated, curved or wave-shaped membrane-electrode-assemblies (MEA) }
- H01M 8/1009 .. { with one of the reactants being liquid, solid or liquid-charged ( [H01M 8/12](#) takes precedence ) }
- H01M 8/1011 ... { Direct methanol fuel cells (DMFC) }
- H01M 8/1013 ... { Other direct alcohol fuel cells (DAFC) }
- H01M 8/1016 .. { characterised by the electrolyte material ( [H01M 8/12](#) takes precedence ) }
- H01M 8/1018 ... { Polymeric electrolyte material }
- H01M 8/102 .... { characterised by the chemical structure of the main chain of the ion conducting polymer ( membrane support [H01M 8/1058](#), semi-permeable membrane composition [B01D 71/00](#), ion-exchange membrane [C08J 5/22](#) ) }

**NOTE**

Multiple classification is done when two or more heteroatoms from O, P, N, S, Si are present

- H01M 8/1023 ..... { having only carbon, e.g. Nafion, vinylsulfonic acid, polyarylenes, polystyrenes, polybutadiene-styrene }
- H01M 8/1025 ..... { having only carbon and oxygen, e.g. polyethers, sulfonated-polyetheretherketones [s-PEEK ], sulfonated-polysaccharides, sulfonated-celluloses, sulfonated-polyesters }
- H01M 8/1027 ..... { having carbon, oxygen and other atoms, e.g. sulfonated-polyethersulfones [s-PES ], sulfonated-polyphenyl-quinoxaline [s-PPQ] }
- H01M 8/103 ..... { having nitrogen, e.g. sulfonated-polybenzimidazoles [s-PBI ], polybenzimidazoles with phosphoric acid, sulfonated-polyamides [s-PA], sulfonated polyphosphazenes [s-PPh] }
- H01M 8/1032 ..... { having sulfur, e.g. sulfonated polyphosphazene [s-PPh] }
- H01M 8/1034 ..... { having phosphorous , e.g. sulfonated polyphosphazene [s-PPh] }
- H01M 8/1037 ..... { having silicon, e.g. sulfonated crosslinked polydimethylsiloxane }
- H01M 8/1039 .... { being halogenated ,e.g. Nafion, sulfonated polyvinylidene fluoride }
- H01M 8/1041 .... { Polymer electrolyte composites, mixtures or blends other than copolymers or grafted polymers }
- H01M 8/1044 ..... { Mixtures of polymers with at least one polymer being ionically conductive }
- H01M 8/1046 ..... { Mixtures of polymer and additives }
- H01M 8/1048 ..... { Ion conductive additives, e.g. polybenzimidazole with phosphoric acid, ion conducting particles, heteropolyacids or metal phosphate }
- H01M 8/1051 ..... { Non ion conductive additives, e.g. stabilizers, SiO<sub>2</sub>, ZrO<sub>2</sub> }
- H01M 8/1053 ..... { 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 | ....  | { characterized by a porous support having no ionic conductive properties ( membrane immobilizing electrolyte solutions or melts <a href="#">H01M 8/0293</a> , <a href="#">H01M 8/0295</a> ) }   |
| H01M 8/106  | ..... | { Chemical composition of the porous support }   |
| H01M 8/1062 | ..... | { Physical properties of the porous support, e.g. porosity, thickness }  |
| H01M 8/1065 | ....  | { characterized by their form, e.g. perforated, undulated ( semi-permeable membranes characterised by their form <a href="#">B01D 69/00</a> ) }  |
| H01M 8/1067 | ....  | { characterized by their physical properties, e.g. porosity, ionic conductivity, thickness }   |
| H01M 8/1069 | ....  | { characterized by the manufacturing processes ( semi-permeable membrane manufacturing processes <a href="#">B01D 67/00</a> ; manufacture of ion-exchange membrane <a href="#">C08J 5/22</a> ) } |
| H01M 8/1072 | ..... | { Chemical reactions, e.g. in-situ polymerisation, 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 polymer solutions, dispersions, slurries other than monomer solutions, dispersions, slurries }   |
| H01M 8/1083 | ..... | { Starting from polymer melts other than monomer melts }   |
| H01M 8/1086 | ..... | { After-treatment of the membrane other than 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 8/1097 | ..    | { Fuel cells applied on a support, e.g. miniature fuel cell deposited on a silica support }  |
| H01M 8/12   | ..    | operating at high temperature, e.g. with stabilised ZrO <sub>2</sub> electrolyte   |
| H01M 8/1206 | ...   | { with the anode and the cathode in the form of gas diffusion electrodes }   |
| H01M 8/1213 | ....  | { characterised by the electrodes, the electrode/electrolyte combination or the supporting material }  |
| H01M 8/122  | ..... | { Undulated, corrugated, curved or wave-shaped membrane electrode assemblies (MEA) }   |
| H01M 8/1226 | ..... | { Supporting layer characteristics }   |
| H01M 8/1233 | ...   | { one of the reactants being solid or liquid }   |
| H01M 8/124  | ...   | { characterised by the process of manufacturing or by the material of the electrolyte }  |
| H01M 8/1246 | ....  | { the electrolyte consisting of oxides ( solid oxides ion conductive electrolyte <a href="#">H01M 2300/0074</a> ) }  |
| H01M 8/1253 | ..... | { the electrolyte containing zirconium oxide ( solid electrolyte based on zirconium oxide <a href="#">H01M 2300/0077</a> ) }   |
| 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 <a href="#">H01M 2300/008</a> ) }   |
| H01M 8/1286 | ...   | { Fuel cells applied on a support, e.g. miniature fuel cells deposited on a silica support }   |

- 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 T01M300/B6H ) }
- 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 into batteries
- H01M 8/2405 .. { comprising spaced diffusion electrodes or electrode layers with interposed electrolyte layer or electrolyte compartment }
- H01M 8/241 ... { with solid or matrix-supported electrolyte }
- H01M 8/2415 .... { External manifolded battery stock ( [H01M 8/2425](#), [H01M 8/244](#) take precedence ) }
- H01M 8/242 .... { comprising framed electrodes or intermediary frame-like gaskets ( [H01M 8/2425](#), [H01M 8/244](#) take precedence ) }
- H01M 8/2425 .... { High-temperature cells with solid electrolyte }
- H01M 8/243 ..... { of tubular or cylindrical configuration }
- H01M 8/2435 ..... { with monolithic core structure, e.g. honeycombs }
- H01M 8/244 .... { with matrix-supported molten electrolyte }
- H01M 8/2445 ... { comprising spaced diffusion electrodes or electrode layers with interposed electrolyte compartment with possible electrolyte supply or circulation }
- H01M 8/245 .... { comprising framed electrodes or intermediary frame-like gaskets }
- H01M 8/2455 .. { with liquid, solid or electrolyte-charged reactants }



- H01M 8/246 ... { with framed electrodes or intermediary frame-like gaskets }
- H01M 8/2465 .. { Details of fuel cell stacks }
- H01M 8/247 ... { Arrangements for tightening a stack, for accommodation of a stack in a tank, for assembling different tanks }
- H01M 8/2475 .... { Enclosures, casings or containers of fuel cells }
- H01M 8/248 .... { Compression means of the fuel cell stack }
- H01M 8/2485 ... { Arrangements for sealing or mounting external manifolds around a stack; Manifold structure and material }
- H01M 8/249 .. { comprising a plurality of stacks, e.g. modular assembly }
- H01M 8/2495 ... { of fuel cells of different type }

## **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 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 10/4207      ..      { 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 ( <a href="#">printed circuits H05K 1/00</a> ) }  |
| H01M 10/4257 | ... | { Smart batteries, e.g. electronic circuits inside the housing of the cells or batteries }  |
| H01M 10/4264 | ... | { with capacitors }   |
| H01M 10/4285 | ..  | { Testing apparatus }   |
| H01M 10/44   | ..  | Methods for charging or discharging ( <a href="#">circuits for charging H02J 7/00</a> )   |
| 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 ( <a href="#">circuits for charging H02J 7/00</a> )  |
| 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 ( { <a href="#">H01M 10/44</a> takes precedence }; <a href="#">indicating or measuring level of liquid in general G01F 23/00</a> ; <a href="#">measuring density G01N</a> , e.g. <a href="#">G01N 9/00</a> ; <a href="#">measuring electric variables G01R</a> ) |
| 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 external visualisation of the condition, e.g. by change of colour or of light intensity }   |
| H01M 10/50   | ..  | Heating or cooling or regulating temperature ( <a href="#">control of temperature in general G05D 23/00</a> )   |
| H01M 10/5002 | ... | { Types of temperature regulation }   |

**WARNING**

Groups [H01M 10/5002](#) to [H01M 10/5097](#) are not complete, pending reclassification. See also [H01M 10/50](#), [H01M 10/50B](#), [T01M 6/50S2-T01M 6/50S2R](#)

|              |       |  |
|--------------|-------|--|
| H01M 10/5004 | ....  | { Cooling or keeping cold }  |
| H01M 10/5006 | ....  | { Heating or keeping warm }  |
| H01M 10/5008 | ....  | { Uniformity or distribution of temperature in space }   |
| H01M 10/501  | ...   | { specially adapted for a specific application }   |
| H01M 10/5012 | ....  | { Portable devices, e.g. mobiles, cameras, pacemakers }  |
| H01M 10/5014 | ..... | { Power tools }  |
| H01M 10/5016 | ....  | { Vehicles }   |
| H01M 10/5018 | ....  | { Stationary plants, e.g. power plant buffering, backup power supplies }   |
| H01M 10/502  | ...   | { Control systems ( <a href="#">measurement of temperature H01M 10/486</a> ; <a href="#">charging and discharging in response to temperature H01M 10/443</a> ) } |
| H01M 10/5022 | ....  | { characterized by method steps, e.g. algorithms, flow charts, software details }  |

|              |       |  |
|--------------|-------|--|
| H01M 10/5024 | ....  | { based on ambient temperature }   |
| H01M 10/5026 | ....  | { characterised by the use of reversible temperature sensitive devices, e.g. NTC, PTC, bimetal or by control of the internal current flowing through the battery, e.g. by switching ( <a href="#">H01M 2/34</a> takes precedence; Temperature sensitive safety devices for primary or secondary batteries <a href="#">H01M 2200/10</a> ) } |
| H01M 10/5028 | ...   | { characterized by the shape of the cells }  |
| H01M 10/503  | ....  | { Cylindrical }  |
| H01M 10/5032 | ....  | { Prismatic or flat, e.g. pouch cells }  |
| H01M 10/5034 | ...   | { Means for temperature regulation having parts combined with the battery }  |
| H01M 10/5036 | ....  | { characterized by values or quantitative relationships, e.g. ratios, sizes, formulas, concentrations }  |
| H01M 10/5038 | ....  | { characterized by gradients ( <a href="#">temperature gradients H01M 10/5008</a> ) }  |
| H01M 10/504  | ....  | { characterized by electrically insulating, thermally conductive materials }   |
| H01M 10/5042 | ....  | { inside the innermost case of the battery, e.g. mandrels, electrodes, electrolytes }  |
| H01M 10/5044 | ....  | { Solid structures for heat-exchange or conduction }   |
| H01M 10/5046 | ..... | { Surfaces specially adapted for heat dissipation or radiation, e.g. fins, coatings }  |
| H01M 10/5048 | ..... | { Closed pipes transferring heat by thermal conductivity and phase transition, e.g. heat pipes }   |
| H01M 10/5051 | ..... | { Terminals or leads }   |
| H01M 10/5053 | ..... | { Solid parts specially adapted for heat conduction other than terminals or leads, e.g. rods, plates }   |
| H01M 10/5055 | ..... | { arranged between the cells }   |
| H01M 10/5057 | ..... | { Solid parts with flow channels or tubes for heat exchange }  |
| H01M 10/5059 | ..... | { arranged between the cells }   |
| H01M 10/5061 | ....  | { Fluids for heat exchange }   |
| H01M 10/5063 | ..... | { Gases }  |
| H01M 10/5065 | ..... | { freely flowing by convection only }  |
| H01M 10/5067 | ..... | { forcedly flowing, e.g. by blowers }  |
| H01M 10/5069 | ..... | { Compressed gases }   |
| H01M 10/5071 | ..... | { Recirculation or a U-turn in the flow path, i.e. back and forth ( <a href="#">H01M 10/5069</a> takes precedence ) }  |
| H01M 10/5073 | ..... | [Means within the gas flows giving the gas flows around a cell or a battery a certain direction, e.g. manifolds, baffles, obstacles]   |
| H01M 10/5075 | ....  | { Liquids }  |
| H01M 10/5077 | ..... | { characterised by flow circuits external to the battery or the battery pack }   |
| H01M 10/5079 | ..... | { Fluids undergoing a liquid-gas phase change, e.g. evaporation, condensation ( <a href="#">heat pipes H01M 10/5048</a> ) }  |
| H01M 10/5081 | ....  | { Electric or electromagnetic means ( <a href="#">H01M 2/34</a> takes precedence ) }   |
| H01M 10/5083 | ..... | { Resistor heaters ( <a href="#">arrangements for heating the battery by its resistance to internal current H01M 10/5026</a> ) }   |
| H01M 10/5085 | ..... | { Peltier elements or thermo-electric devices }  |
| H01M 10/5087 | ....  | { Thermal insulation or shielding }  |
| H01M 10/5089 | ....  | { Heat storage or buffering, e.g. heat capacity, liquid-solid phase changes }  |

- H01M 10/5091 . . . . { Chemical reactions other than electrochemical reactions of the battery, e.g. catalytic heaters, burners }
- H01M 10/5093 . . . { Heat exchange relationships between a battery and another system, e.g. air-conditioners, central heating systems, vehicle engines, electronic components, fuel cells, capacitors }
- H01M 10/5095 . . . . { the system being an air-conditioner or an engine }
- H01M 10/5097 . . . . { the system being an electronic component, e.g. CPU, inverter, capacitor }
- 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 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 . { Photoelectrochemical storage cells ( light sensitive devices [H01G 9/20](#), semiconductors sensitive to light [H01L 131/00](#) ) }

## **H01M 16/00 Structural combinations of different types of electrochemical generators**

- H01M 16/003 . { of fuel cells with other electrochemical devices, e.g. capacitors, electrolyzers }
- H01M 16/006 . . { of fuel cells with rechargeable batteries }

**H01M 2002/00****Constructional details or processes of manufacture of the non-active parts**

- H01M 2002/02 . Cases, jackets or wrappings ( [working of plastics or substances in plastic stateB29](#) )
- H01M 2002/0202 .. { [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](#) to [T01M 2/02B6](#)
- H01M 2002/0257 .. { [characterised by the material](#) }
- [H01M 2002/0297](#) ... characterised by physical parameters

**H01M 2004/00****Electrodes ( [electrodes for electrolytic processes C25](#) , { [electrodes for hybrid or electric double capacitor H01G 11/22](#) } )**

- H01M 2004/02 . 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 2004/86 . Inert electrodes with catalytic activity, e.g. for fuel cells
- [H01M 2004/8678](#) .. characterised by the polarity
- [H01M 2004/8684](#) ... Negative electrodes
- [H01M 2004/8689](#) ... Positive electrodes
- [H01M 2004/8694](#) ... Bipolar electrodes

**H01M 2006/00****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 2006/04 . Cells with aqueous electrolyte
- H01M 2006/06 .. Dry cells, i.e. cells wherein the electrolyte is rendered non-fluid
- H01M 2006/10 ... with wound or folded electrodes
- [H01M 2006/106](#) .... Elliptic wound cells
- H01M 2006/50 . Methods or arrangements for servicing or maintenance, e.g. maintaining operating temperature { ( [cells or batteries combined with safety devices H01M 2200/00](#) ) }
- [H01M 2006/5094](#) .. Aspects relating to capacity ratio of electrolyte/electrodes or anode/cathode



**H01M 2008/00      Fuel cells; Manufacture thereof****NOTE**

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

- H01M 2008/10      .    Fuel cells with solid electrolytes
- [H01M 2008/1095](#)    . .    Fuel cells with polymeric electrolytes
- H01M 2008/12      . .    operating at high temperature, e.g. with stabilised ZrO<sub>2</sub> electrolyte
- [H01M 2008/128](#)    . . .    Fuel cells with solid halide electrolytes
- [H01M 2008/1293](#)    . . .    Fuel cells with solid oxide electrolytes
- H01M 2008/14      .    Fuel cells with fused electrolytes
- [H01M 2008/147](#)    . .    Fuel cells with molten carbonates

**H01M 2010/00      Secondary cells; Manufacture thereof****NOTE**

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

- H01M 2010/04      .    Construction or manufacture in general ( [H01M 10/12](#), [H01M 10/28](#), [H01M 10/38](#) take precedence )
- [H01M 2010/0495](#)    . .    Nanobatteries
- H01M 2010/42      .    Methods or arrangements for servicing or maintenance of secondary cells or secondary half-cells
- H01M 2010/425      . .    { Structural combination with electronic components, e.g. electronic circuits integrated to the outside of the casing ( [printed circuits H05K 1/00](#) ) }
- [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 2010/4292](#)    . .    Aspects relating to capacity ratio of electrodes/electrolyte or anode/cathode

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

- [H01M 2200/10](#)      .    Temperature sensitive devices
- [H01M 2200/101](#)    . .    Bimetal
- [H01M 2200/103](#)    . .    Fuse
- [H01M 2200/105](#)    . .    NTC
- [H01M 2200/106](#)    . .    PTC
- [H01M 2200/108](#)    . .    Normal resistors

H01M 2200/20 . Pressure-sensitive devices

H01M 2200/30 . Preventing polarity reversal

### **H01M 2220/00 Batteries for particular applications**

H01M 2220/10 . Batteries in stationary systems, e.g. emergency power source in plant

H01M 2220/20 . Batteries in motive systems, e.g. vehicle, ship, plane

H01M 2220/30 . Batteries in portable systems, e.g. mobile phone, laptop

### **H01M 2250/00 Fuel cells for particular applications; Specific features of fuel cell system**

H01M 2250/10 . Fuel cells in stationary systems, e.g. emergency power source in plant

H01M 2250/20 . Fuel cells in motive systems, e.g. vehicle, ship, plane

H01M 2250/30 . Fuel cells in portable systems, e.g. mobile phone, laptop

H01M 2250/40 . Combination of fuel cells with other energy production systems

H01M 2250/402 . . Combination of fuel cell with other electric generators ( [combination of fuel cells with other electrochemical generator H01M 16/003](#) )

H01M 2250/405 . . Cogeneration of heat or hot water

H01M 2250/407 . . Combination of fuel cells with mechanical energy generators

### **H01M 2300/00 Electrolytes**

H01M 2300/0002 . Aqueous electrolytes

H01M 2300/0005 . . Acid electrolytes

H01M 2300/0008 . . . Phosphoric acid-based

H01M 2300/0011 . . . Sulfuric acid-based

H01M 2300/0014 . . Alkaline electrolytes

H01M 2300/0017 . Non-aqueous electrolytes

H01M 2300/002 . . Inorganic electrolyte

H01M 2300/0022 . . . Room temperature molten salts

H01M 2300/0025 . . Organic electrolyte

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                           |