

CPC COOPERATIVE PATENT CLASSIFICATION

H ELECTRICITY

(NOTE omitted)

H01 ELECTRIC ELEMENTS

(NOTES omitted)

H01M PROCESSES OR MEANS, e.g. BATTERIES, FOR THE DIRECT CONVERSION OF CHEMICAL ENERGY INTO ELECTRICAL ENERGY

NOTE

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

WARNING

In this subclass non-limiting references (in the sense of paragraph 39 of the Guide to the IPC) may still be displayed in the scheme.

<p>4/00 Electrodes</p> <p>NOTE</p> <p>In classifying electrodes of hybrid cells, the individual half-cells of the hybrid cell are considered separately, e.g. an electrode in the primary half of a primary/fuel type hybrid cell is considered to be a primary-cell electrode covered by H01M 4/06.</p> <p>4/02 . Electrodes composed of, or comprising, active material</p> <p>2004/021 . . {Physical characteristics, e.g. porosity, surface area}</p> <p>2004/022 . . {Electrodes made of one single microscopic fiber}</p> <p>2004/023 . . {Gel electrode}</p> <p>2004/024 . . {Insertable electrodes}</p> <p>2004/025 . . {with shapes other than plane or cylindrical}</p> <p>2004/026 . . {characterised by the polarity}</p> <p>2004/027 . . . {Negative electrodes}</p> <p>2004/028 . . . {Positive electrodes}</p> <p>2004/029 . . . {Bipolar electrodes}</p> <p>4/04 . . Processes of manufacture in general</p> <p>4/0402 . . . {Methods of deposition of the material}</p> <p>4/0404 {by coating on electrode collectors}</p> <p>4/0407 {by coating on an electrolyte layer}</p> <p>4/0409 {by a doctor blade method, slip-casting or roller coating}</p> <p>4/0411 {by extrusion}</p> <p>4/0414 {by screen printing}</p> <p>4/0416 {involving impregnation with a solution, dispersion, paste or dry powder (H01M 4/0438 takes precedence)}</p> <p>4/0419 {involving spraying}</p> <p>4/0421 {involving vapour deposition}</p> <p>4/0423 {Physical vapour deposition}</p> <p>4/0426 {Sputtering}</p> <p>4/0428 {Chemical vapour deposition}</p> <p>4/043 . . . {involving compressing or compaction}</p> <p>4/0433 {Molding}</p> <p>4/0435 {Rolling or calendering}</p>	<p>4/0438 {by electrochemical processing (electroless electrochemical plating C23C 18/54)}</p> <p>4/044 {Activating, forming or electrochemical attack of the supporting material}</p> <p>4/0442 {Anodisation, Oxidation (electrolytic coating by anodisation C25D 9/00)}</p> <p>4/0445 {Forming after manufacture of the electrode, e.g. first charge, cycling}</p> <p>4/0447 {of complete cells or cells stacks}</p> <p>4/045 {Electrochemical coating; Electrochemical impregnation}</p> <p>4/0452 {from solutions}</p> <p>4/0454 {from melts}</p> <p>4/0457 {from dispersions or suspensions; Electrophoresis}</p> <p>4/0459 {Electrochemical doping, intercalation, occlusion or alloying}</p> <p>4/0461 {Electrochemical alloying}</p> <p>4/0464 {Electro organic synthesis}</p> <p>4/0466 {Electrochemical polymerisation}</p> <p>4/0469 {Electroforming a self-supporting electrode; Electroforming of powdered electrode material}</p> <p>4/0471 {involving thermal treatment, e.g. firing, sintering, backing particulate active material, thermal decomposition, pyrolysis}</p> <p>4/0473 {Filling tube-or-pockets type electrodes; Applying active mass in cup-shaped terminals}</p> <p>4/0476 {with molten material}</p> <p>4/0478 {with dispersions, suspensions or pastes}</p> <p>4/048 {with dry powder}</p> <p>4/0483 {by methods including the handling of a melt (H01M 4/0438, take precedence)}</p> <p>4/0485 {Casting}</p> <p>4/0488 {Alloying}</p> <p>4/049 {Manufacturing of an active layer by chemical means}</p> <p>4/0492 {Chemical attack of the support material}</p> <p>4/0495 {Chemical alloying}</p> <p>4/0497 {Chemical precipitation}</p> <p>4/06 . . Electrodes for primary cells</p> <p>4/08 . . . Processes of manufacture</p>
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- 4/10 of pressed electrodes with central core, i.e. dollies
- 4/12 of consumable metal or alloy electrodes (use of alloy compositions as active materials [H01M 4/38](#))
- 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](#)
- 4/131 . . . Electrodes based on mixed oxides or hydroxides, or on mixtures of oxides or hydroxides, e.g. LiCoOx
- 4/1315 containing halogen atoms, e.g. LiCoOxFy
- 4/133 . . . Electrodes based on carbonaceous material, e.g. graphite-intercalation compounds or CFx
- 4/134 . . . Electrodes based on metals, Si or alloys
- 4/136 . . . Electrodes based on inorganic compounds other than oxides or hydroxides, e.g. sulfides, selenides, tellurides, halogenides or LiCoFy
- 4/137 . . . Electrodes based on electro-active polymers
- 4/139 . . . Processes of manufacture
- 4/1391 of electrodes based on mixed oxides or hydroxides, or on mixtures of oxides or hydroxides, e.g. LiCoOx
- 4/13915 containing halogen atoms, e.g. LiCoOxFy
- 4/1393 of electrodes based on carbonaceous material, e.g. graphite-intercalation compounds or CFx
- 4/1395 of electrodes based on metals, Si or alloys
- 4/1397 of electrodes based on inorganic compounds other than oxides or hydroxides, e.g. sulfides, selenides, tellurides, halogenides or LiCoFy
- 4/1399 of electrodes based on electro-active polymers
- 4/14 . . Electrodes for lead-acid accumulators
- 4/16 . . . Processes of manufacture
- 4/18 of Planté electrodes
- 4/20 of pasted electrodes
- 4/21 Drying of pasted electrodes
- 4/22 Forming of electrodes
- 4/23 Drying or preserving electrodes after forming
- 4/24 . . Electrodes for alkaline accumulators
- 4/242 . . . {Hydrogen storage electrodes}
- 4/244 . . . {Zinc electrodes}
- 4/246 . . . {Cadmium electrodes}
- 4/248 . . . {Iron electrodes}
- 4/26 . . . Processes of manufacture
- 4/28 Precipitating active material on the carrier
- 4/29 by electrochemical methods
- 4/30 Pressing
- 4/32 . . . Nickel oxide or hydroxide electrodes
- 4/34 . . . Silver oxide or hydroxide electrodes
- 4/36 . . Selection of substances as active materials, active masses, active liquids
- 4/362 . . . {Composites}
- 4/364 {as mixtures}
- 4/366 {as layered products}
- 4/368 . . . {Liquid depolarisers}
- 4/38 of elements or alloys
- 4/381 {Alkaline or alkaline earth metals elements ([H01M 4/40](#) takes precedence)}
- 4/382 {Lithium ([H01M 4/405](#) takes precedence)}
- 4/383 {Hydrogen absorbing alloys}
- 4/385 {of the type LaNi₅}
- 4/386 {Silicon or alloys based on silicon}
- 4/387 {Tin or alloys based on tin}
- 4/388 {Halogens}
- 4/40 Alloys based on alkali metals
- 4/405 {Alloys based on lithium}
- 4/42 Alloys based on zinc
- 4/44 Alloys based on cadmium
- 4/46 Alloys based on magnesium or aluminium
- 4/463 {Aluminium based}
- 4/466 {Magnesium based}
- 4/48 . . . of inorganic oxides or hydroxides
- 4/481 {of mercury}
- 4/483 {for non-aqueous cells ([H01M 4/485](#) takes precedence)}
- 4/485 of mixed oxides or hydroxides for inserting or intercalating light metals, e.g. LiTi₂O₄ or LiTi₂OxFy ([H01M 4/505](#), [H01M 4/525](#) take precedence)
- 4/50 of manganese
- 4/502 {for non-aqueous cells ([H01M 4/505](#) takes precedence)}
- 4/505 of mixed oxides or hydroxides containing manganese for inserting or intercalating light metals, e.g. LiMn₂O₄ or LiMn₂OxFy
- 4/52 of nickel, cobalt or iron
- 4/521 {of iron for aqueous cells}
- 4/523 {for non-aqueous cells ([H01M 4/525](#) takes precedence)}
- 4/525 of mixed oxides or hydroxides containing iron, cobalt or nickel for inserting or intercalating light metals, e.g. LiNiO₂, LiCoO₂ or LiCoOxFy
- 4/54 of silver
- 4/56 of lead
- 4/57 of "grey lead", i.e. powders containing lead and lead oxide
- 4/58 . . . of inorganic compounds other than oxides or hydroxides, e.g. sulfides, selenides, tellurides, halogenides or LiCoFy; of polyanionic structures, e.g. phosphates, silicates or borates
- 4/5805 {Phosphides}
- 4/581 {Chalcogenides or intercalation compounds thereof}
- 4/5815 {Sulfides}
- 4/582 {Halogenides}
- 4/5825 {Oxygenated metallic salts 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.}
- 4/583 Carbonaceous material, e.g. graphite-intercalation compounds or CFx

- 4/5835 {Comprising fluorine or fluoride salts}
- 4/587 for inserting or intercalating light metals
- 4/60 of organic compounds
- 4/602 {Polymers}
- 4/604 {containing aliphatic main chain polymers}
- 4/606 {containing aromatic main chain polymers}
- 4/608 {containing heterocyclic rings}
- 4/62 Selection of inactive substances as ingredients for active masses, e.g. binders, fillers
- 4/621 {Binders}
- 4/622 {being polymers}
- 4/623 {fluorinated polymers}
- 4/624 {Electric conductive fillers}
- 4/625 {Carbon or graphite}
- 4/626 {Metals}
- 4/627 {Expanders for lead-acid accumulators}
- 4/628 {Inhibitors, e.g. gassing inhibitors, corrosion inhibitors}
- 4/64 Carriers or collectors
- 4/66 Selection of materials
- 4/661 {Metal or alloys, e.g. alloy coatings
(H01M 4/669 take precedence)}
- 4/662 {Alloys (collectors of lead alloys
(H01M 4/685))}
- 4/663 {containing carbon or carbonaceous materials as conductive part, e.g. graphite, carbon fibres}
- 4/664 {Ceramic materials}
- 4/665 {Composites}
- 4/666 {in the form of mixed materials
(H01M 4/668 takes precedence)}
- 4/667 {in the form of layers, e.g. coatings}
- 4/668 {Composites of electroconductive material and synthetic resins}
- 4/669 {Steels}
- 4/68 for use in lead-acid accumulators
- 4/685 {Lead alloys}
- 4/70 characterised by shape or form
- 4/72 Grids
- 4/73 for lead-acid accumulators, e.g. frame plates
- 4/74 Meshes or woven material; Expanded metal
- 4/742 {perforated material}
- 4/745 {Expanded metal}
- 4/747 {Woven material}
- 4/75 Wires, rods or strips
- 4/76 Containers for holding the active material, e.g. tubes, capsules
- 4/762 {Porous or perforated metallic containers}
- 4/765 {Tubular type or pencil type electrodes; tubular or multitubular sheaths or covers of insulating material for said tubular-type electrodes}
- 4/767 {Multitubular sheaths or covers}
- 4/78 Shapes other than plane or cylindrical, e.g. helical
- 4/80 Porous plates, e.g. sintered carriers
- 4/801 {Sintered carriers}
- 4/803 {of only powdered material}
- 4/805 {of powdered and fibrous material}
- 4/806 {Nonwoven fibrous fabric containing only fibres}
- 4/808 {Foamed, spongy materials}
- 4/82 Multi-step processes for manufacturing carriers for lead-acid accumulators
- 4/84 involving casting
- 4/86 Inert electrodes with catalytic activity, e.g. for fuel cells
- 4/8605 {Porous electrodes}
- 4/861 {with a gradient in the porosity}
- 4/8615 {Bifunctional electrodes for rechargeable cells}
- 4/8621 {containing only metallic or ceramic material, e.g. made by sintering or sputtering}
- 4/8626 {characterised by the form}
- 4/8631 {Bipolar electrodes}
- 4/8636 {with a gradient in another property than porosity
(H01M 4/861 takes precedence)}
- 4/8642 {Gradient in composition}
- 4/8647 {consisting of more than one material, e.g. consisting of composites}
- 4/8652 {as mixture}
- 4/8657 {layered}
- 4/8663 {Selection of inactive substances as ingredients for catalytic active masses, e.g. binders, fillers}
- 4/8668 {Binders}
- 4/8673 {Electrically conductive fillers}
- 2004/8678 {characterised by the polarity}
- 2004/8684 {Negative electrodes}
- 2004/8689 {Positive electrodes}
- 2004/8694 {Bipolar electrodes}
- 4/88 Processes of manufacture
- 4/8803 {Supports for the deposition of the catalytic active composition (H01M 4/90 takes precedence)}
- 4/8807 {Gas diffusion layers}
- 4/881 {Electrolytic membranes}
- 4/8814 {Temporary supports, e.g. decal}
- 4/8817 {Treatment of supports before application of the catalytic active composition (coated porous composites H01M 8/0245)}
- 4/8821 {Wet proofing}
- 4/8825 {Methods for deposition of the catalytic active composition}
- 4/8828 {Coating with slurry or ink}
- 4/8832 {Ink jet printing}
- 4/8835 {Screen printing}
- 4/8839 {Painting}
- 4/8842 {Coating using a catalyst salt precursor in solution followed by evaporation and reduction of the precursor}
- 4/8846 {Impregnation}
- 4/885 {followed by reduction of the catalyst salt precursor}
- 4/8853 {Electrodeposition}
- 4/8857 {Casting, e.g. tape casting, vacuum slip casting}
- 4/886 {Powder spraying, e.g. wet or dry powder spraying, plasma spraying}
- 4/8864 {Extrusion}
- 4/8867 {Vapour deposition}
- 4/8871 {Sputtering}

- 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}
- 4/8878 . . . {Treatment steps after deposition of the catalytic active composition or after shaping of the electrode being free-standing body}
- 4/8882 {Heat treatment, e.g. drying, baking}
- 4/8885 {Sintering or firing}
- 4/8889 {Cosintering or cofiring of a catalytic active layer with another type of layer}
- 4/8892 {Impregnation or coating of the catalyst layer, e.g. by an ionomer}
- 4/8896 {Pressing, rolling, calendaring (membrane electrode assemblies [H01M 8/1004](#))}
- 4/90 . . Selection of catalytic material
- 4/9008 . . . {Organic or organo-metallic compounds}
- 4/9016 . . . {Oxides, hydroxides or oxygenated metallic salts}
- 4/9025 {Oxides specially used in fuel cell operating at high temperature, e.g. SOFC}
- 4/9033 {Complex oxides, optionally doped, of the type M1MeO₃, M1 being an alkaline earth metal or a rare earth, Me being a metal, e.g. perovskites}
- 4/9041 . . . {Metals or alloys ([H01M 4/92](#) takes precedence)}
- 4/905 {specially used in fuel cell operating at high temperature, e.g. SOFC}
- 4/9058 {of noble metals or noble-metal based alloys}
- 4/9066 {of metal-ceramic composites or mixtures, e.g. cermets}
- 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)}
- 4/9083 {on carbon or graphite}
- 4/9091 . . . {Unsupported catalytic particles; loose particulate catalytic materials, e.g. in fluidised state}
- 4/92 . . . Metals of platinum group ([H01M 4/94](#) {, [H01M 4/9058](#)} take precedence)
- 4/921 {Alloys or mixtures with metallic elements}
- 4/923 {Compounds thereof with non-metallic elements}
- 4/925 {supported on carriers, e.g. powder carriers}
- 4/926 {on carbon or graphite}
- 4/928 {Unsupported catalytic particles; loose particulate catalytic materials, e.g. in fluidised state}
- 4/94 . . Non-porous diffusion electrodes, e.g. palladium membranes, ion exchange membranes
- 4/96 . . Carbon-based electrodes
- 4/98 . . Raney-type electrodes
- 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.
- 6/005 . . {Devices for making primary cells}
- 6/02 . . Details (of electrodes [H01M 4/00](#); of non-active parts [H01M 50/00](#))
- 6/04 . . Cells with aqueous electrolyte
- 6/045 . . . {characterised by aqueous electrolyte}
- 6/06 . . Dry cells, i.e. cells wherein the electrolyte is rendered non-fluid
- 6/08 . . . with cup-shaped electrodes
- 6/085 {of the reversed type, i.e. anode in the centre}
- 6/10 . . . with wound or folded electrodes
- 6/103 {Cells with electrode of only one polarity being folded or wound}
- 2006/106 {Elliptic wound cells}
- 6/12 . . . with flat electrodes
- 6/14 . . Cells with non-aqueous electrolyte
- 6/145 . . {containing ammonia}
- 6/16 . . with organic electrolyte ([H01M 6/18](#) takes precedence)
- 6/162 . . . {characterised by the electrolyte}
- 6/164 {by the solvent}
- 6/166 {by the solute}
- 6/168 {by additives}
- 6/18 . . with solid electrolyte
- 6/181 . . . {with polymeric electrolytes}
- 6/182 . . . {with halogenide as solid electrolyte}
- 6/183 {with fluoride as solid electrolyte}
- 6/185 . . . {with oxides, hydroxides or oxysalts as solid electrolytes}
- 6/186 {Only oxysalts-containing solid electrolytes}
- 6/187 . . . {Solid electrolyte characterised by the form}
- 6/188 . . . {Processes of manufacture}
- 6/20 . . . working at high temperature (deferred-action thermal cells [H01M 6/36](#))
- 6/22 . . Immobilising of electrolyte
- 6/24 . . Cells comprising two different electrolytes
- 6/26 . . Cells without oxidising active material, e.g. Volta cells
- 6/28 . . Standard cells, e.g. Weston cells
- 6/30 . . Deferred-action cells
- 6/32 . . activated through external addition of electrolyte or of electrolyte components
- 6/34 . . . Immersion cells, e.g. sea-water cells
- 6/36 . . containing electrolyte and made operational by physical means, e.g. thermal cells
- 6/38 . . . by mechanical means
- 6/385 {by insertion of electrodes}
- 6/40 . . Printed batteries {, e.g. thin film batteries}
- 6/42 . . Grouping of primary cells into batteries ([H01M 6/40](#) takes precedence)
- 6/425 . . {Multimode batteries, batteries with "reserve cells"}
- 6/44 . . of tubular or cup-shaped cells
- 6/46 . . of flat cells
- 6/48 . . . with bipolar electrodes
- 6/485 {Side-by-side bipolar batteries}
- 6/50 . . Methods or arrangements for servicing or maintenance, e.g. for maintaining operating temperature (constructional details of current conducting connections for detecting conditions inside cells or batteries, e.g. details of voltage sensing terminals, [H01M 50/569](#))
- 6/5005 . . . {Auxiliary electrodes}
- 6/5011 . . . {for several cells simultaneously or successively}
- 6/5016 . . . {Multimode utilisation}

- 6/5022 . . {Arrangements for moving electrodes or separating elements}
- 6/5027 . . {Dummy cells}
- 6/5033 . . {used as charging means for another battery}
- 6/5038 . . {Heating or cooling of cells or batteries}
- 6/5044 . . {Cells or batteries structurally combined with cell condition indicating means}
- 6/505 . . . {Cells combined with indicating means for external visualization of the condition, e.g. by change of colour or of light intensity}
- 6/5055 . . . {End of discharge indicated by a voltage step}
- 6/5061 . . . {Cells combined with sound indicating means}
- 6/5066 . . {Type recognition}
- 6/5072 . . {Preserving or storing cells}
- 6/5077 . . {Regeneration of reactants or electrolyte}
- 6/5083 . . {Testing apparatus}
- 6/5088 . . {Initial activation; predischage; Stabilisation of initial voltage}
- 2006/5094 . . {Aspects relating to capacity ratio of electrolyte/ electrodes or anode/cathode}
- 6/52 . Reclaiming serviceable parts of waste cells or batteries {, e.g. recycling}
- 8/00 Fuel cells; Manufacture thereof**
- NOTE**
- In this group, the following expression is used with the meaning indicated:
- "Fuel cell" means an electrochemical generator wherein the reactants are supplied from outside.
- 8/002 . {Shape, form of a fuel cell}
- 8/004 . . {Cylindrical, tubular or wound}
- 8/006 . . {Flat}
- 8/008 . Disposal or recycling of fuel cells
- 8/02 . Details ([electrodes H01M 4/86 - H01M 4/98](#))
- 8/0202 . . Collectors; Separators, e.g. bipolar separators; Interconnectors
- 8/0204 . . . Non-porous and characterised by the material
- 8/0206 Metals or alloys
- 8/0208 Alloys
- 8/021 Alloys based on iron
- 8/0213 Gas-impermeable carbon-containing materials
- 8/0215 Glass; Ceramic materials
- 8/0217 Complex oxides, optionally doped, of the type AMO₃, A being an alkaline earth metal or rare earth metal and M being a metal, e.g. perovskites
- 8/0219 {Chromium complex oxides}
- 8/0221 Organic resins; Organic polymers
- 8/0223 Composites
- 8/0226 in the form of mixtures
- 8/0228 in the form of layered or coated products
- 8/023 . . . Porous and characterised by the material
- 8/0232 Metals or alloys
- 8/0234 Carbonaceous material
- 8/0236 Glass; Ceramics; Cermets
- 8/0239 Organic resins; Organic polymers
- 8/0241 Composites
- 8/0243 in the form of mixtures
- 8/0245 in the form of layered or coated products
- 8/0247 . . . characterised by the form ([characterised by a channel configuration H01M 8/0258](#))
- 8/025 semicylindrical
- 8/0252 tubular
- 8/0254 corrugated or undulated
- 8/0256 Vias, i.e. connectors passing through the separator material
- 8/0258 . . . characterised by the configuration of channels, e.g. by the flow field of the reactant or coolant
- 8/026 characterised by grooves, e.g. their pitch or depth
- 8/0263 having meandering or serpentine paths
- 8/0265 the reactant or coolant channels having varying cross sections
- 8/0267 . . . having heating or cooling means, e.g. heaters or coolant flow channels
- 8/0269 . . . {Separators, collectors or interconnectors including a printed circuit board}
- 8/0271 . . Sealing or supporting means around electrodes, matrices or membranes
- 8/0273 . . . with sealing or supporting means in the form of a frame
- 8/0276 . . . Sealing means characterised by their form ([H01M 8/0273 takes precedence](#))
- 8/0278 {O-rings}
- 8/028 . . . Sealing means characterised by their material
- 8/0282 Inorganic material
- 8/0284 Organic resins; Organic polymers
- 8/0286 . . . Processes for forming seals
- 8/0289 . . Means for holding the electrolyte ([solid polymer electrolytes H01M 8/1018](#))
- 8/0293 . . . Matrices for immobilising electrolyte solutions
- 8/0295 . . . Matrices for immobilising electrolyte melts
- 8/0297 . . Arrangements for joining electrodes, reservoir layers, heat exchange units or bipolar separators to each other ([H01M 8/0271 takes precedence](#))
- 8/04 . Auxiliary arrangements, e.g. for control of pressure or for circulation of fluids
- 8/04007 . . related to heat exchange
- 8/04014 . . . Heat exchange using gaseous fluids; Heat exchange by combustion of reactants
- 8/04022 {Heating by combustion}
- 8/04029 . . . Heat exchange using liquids
- 8/04037 . . . {Electrical heating}
- 8/04044 . . . Purification of heat exchange media
- 8/04052 . . . {Storage of heat in the fuel cell system}
- 8/04059 . . . {Evaporative processes for the cooling of a fuel cell}
- 8/04067 . . . {Heat exchange or temperature measuring elements, thermal insulation, e.g. heat pipes, heat pumps, fins}
- 8/04074 {Heat exchange unit structures specially adapted for fuel cell}
- 8/04082 . . Arrangements for control of reactant parameters, e.g. pressure or concentration
- 8/04089 . . . of gaseous reactants
- 8/04097 {with recycling of the reactants ([H01M 8/04119, H01M 8/04104 take precedence](#))}
- 8/04104 {Regulation of differential pressures}
- 8/04111 using a compressor turbine assembly
- 8/04119 with simultaneous supply or evacuation of electrolyte; Humidifying or dehumidifying
- 8/04126 {Humidifying}
- 8/04134 {by coolants}

8/04141	{by water containing exhaust gases}	8/0438	Pressure; Ambient pressure; Flow
8/04149	{by diffusion, e.g. making use of membranes}	8/04388	{of anode reactants at the inlet or inside the fuel cell}
8/04156	{with product water removal}	8/04395	{of cathode reactants at the inlet or inside the fuel cell}
8/04164	{by condensers, gas-liquid separators or filters}	8/04402	{of anode exhausts}
8/04171	{using adsorbents, wicks or hydrophilic material}	8/0441	{of cathode exhausts}
8/04179	{by purging or increasing flow or pressure of reactants}	8/04417	{of the coolant}
8/04186	of liquid-charged or electrolyte-charged reactants	8/04425	{at auxiliary devices, e.g. reformers, compressors, burners}
8/04194	{Concentration measuring cells}	8/04432	{Pressure differences, e.g. between anode and cathode}
8/04197	{Preventing means for fuel crossover}	8/0444	Concentration; Density (H01M 8/04492 takes precedence)
8/04201	{Reactant storage and supply, e.g. means for feeding, pipes}	8/04447	{of anode reactants at the inlet or inside the fuel cell}
8/04208	{Cartridges, cryogenic media or cryogenic reservoirs}	8/04455	{of cathode reactants at the inlet or inside the fuel cell}
8/04216	{characterised by the choice for a specific material, e.g. carbon, hydride, absorbent}	8/04462	{of anode exhausts}
8/04223	during start-up or shut-down; Depolarisation or activation, e.g. purging; Means for short-circuiting defective fuel cells	8/0447	{of cathode exhausts}
8/04225	during start-up	8/04477	{of the electrolyte}
8/04228	during shut-down	8/04485	{of the coolant}
8/04231	{Purging of the reactants}	8/04492	Humidity; Ambient humidity; Water content
8/04238	{Depolarisation}	8/045	{of anode reactants at the inlet or inside the fuel cell}
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)}	8/04507	{of cathode reactants at the inlet or inside the fuel cell}
8/04253	{Means for solving freezing problems}	8/04514	{of anode exhausts}
8/04268	{Heating of fuel cells during the start-up of the fuel cells}	8/04522	{of cathode exhausts}
8/04276	Arrangements for managing the electrolyte stream, e.g. heat exchange	8/04529	{of the electrolyte}
8/04283	{Supply means of electrolyte to or in matrix-fuel cells}	8/04537	Electric variables
8/04291	Arrangements for managing water in solid electrolyte fuel cell systems (H01M 8/04119 takes precedence)	8/04544	{Voltage}
8/04298	Processes for controlling fuel cells or fuel cell systems	8/04552	{of the individual fuel cell}
8/043	applied during specific periods	8/04559	{of fuel cell stacks}
8/04302	applied during start-up	8/04567	{of auxiliary devices, e.g. batteries, capacitors}
8/04303	applied during shut-down	8/04574	{Current}
8/04305	{Modeling, demonstration models of fuel cells, e.g. for training purposes}	8/04582	{of the individual fuel cell}
8/04313	characterised by the detection or assessment of variables; characterised by the detection or assessment of failure or abnormal function	8/04589	{of fuel cell stacks}
8/0432	Temperature; Ambient temperature	8/04597	{of auxiliary devices, e.g. batteries, capacitors}
8/04328	{of anode reactants at the inlet or inside the fuel cell}	8/04604	{Power, energy, capacity or load}
8/04335	{of cathode reactants at the inlet or inside the fuel cell}	8/04611	{of the individual fuel cell}
8/04343	{of anode exhausts}	8/04619	{of fuel cell stacks}
8/0435	{of cathode exhausts}	8/04626	{of auxiliary devices, e.g. batteries, capacitors}
8/04358	{of the coolant}	8/04634	{Other electric variables, e.g. resistance or impedance}
8/04365	{of other components of a fuel cell or fuel cell stacks}	8/04641	{of the individual fuel cell}
8/04373	{of auxiliary devices, e.g. reformers, compressors, burners}	8/04649	{of fuel cell stacks}
		8/04656	{of auxiliary devices, e.g. batteries, capacitors}
		8/04664	Failure or abnormal function
		8/04671	{of the individual fuel cell}
		8/04679	{of fuel cell stacks}
		8/04686	{of auxiliary devices, e.g. batteries, capacitors}
		8/04694	characterised by variables to be controlled
		8/04701	Temperature
		8/04708	{of fuel cell reactants}
		8/04716	{of fuel cell exhausts}
		8/04723	{of the coolant}

- 8/04731 {of other components of a fuel cell or fuel cell stacks}
- 8/04738 {of auxiliary devices, e.g. reformer, compressor, burner}
- 8/04746 Pressure; Flow
- 8/04753 {of fuel cell reactants}
- 8/04761 {of fuel cell exhausts}
- 8/04768 {of the coolant}
- 8/04776 {at auxiliary devices, e.g. reformer, compressor, burner}
- 8/04783 {Pressure differences, e.g. between anode and cathode}
- 8/04791 Concentration; Density ([H01M 8/04828](#) takes precedence)
- 8/04798 {of fuel cell reactants}
- 8/04805 {of fuel cell exhausts}
- 8/04813 {of the coolant}
- 8/0482 {of the electrolyte}
- 8/04828 Humidity; Water content
- 8/04835 {of fuel cell reactants}
- 8/04843 {of fuel cell exhausts}
- 8/0485 {of the electrolyte}
- 8/04858 Electric variables
- 8/04865 {Voltage}
- 8/04873 {of the individual fuel cell}
- 8/0488 {of fuel cell stacks}
- 8/04888 {of auxiliary devices, e.g. batteries, capacitors}
- 8/04895 {Current}
- 8/04902 {of the individual fuel cell}
- 8/0491 {of fuel cell stacks}
- 8/04917 {of auxiliary devices, e.g. batteries, capacitors}
- 8/04925 {Power, energy, capacity or load}
- 8/04932 {of the individual fuel cell}
- 8/0494 {of fuel cell stacks}
- 8/04947 {of auxiliary devices, e.g. batteries, capacitors}
- 8/04949 {other electric variables, e.g. resistance or impedance}
- 8/04951 {of the individual fuel cell}
- 8/04952 {of fuel cell stacks}
- 8/04953 {of auxiliary devices, e.g. batteries, capacitors}
- 8/04955 Shut-off or shut-down of fuel cells
- 8/04992 characterised by the implementation of mathematical or computational algorithms, e.g. feedback control loops, fuzzy logic, neural networks or artificial intelligence
- 8/06 Combination of fuel cells with means for production of reactants or for treatment of residues ([regenerative fuel cells H01M 8/18](#))
- 8/0606 with means for production of gaseous reactants
- 8/0612 from carbon-containing material
- 8/0618 {Reforming processes, e.g. autothermal, partial oxidation or steam reforming}
- 8/0625 {in a modular combined reactor/fuel cell structure}
- 8/0631 {Reactor construction specially adapted for combination reactor/fuel cell ([hydrogen C01B 3/00](#); [reactors for physicochemical processes B01J 19/00](#))}
- 8/0637 Direct internal reforming at the anode of the fuel cell
- 8/0643 {Gasification of solid fuel}
- 8/065 by dissolution of metals or alloys; by dehydrating metallic substances
- 8/0656 by electrochemical means ([H01M 8/065](#) takes precedence)
- 8/0662 Treatment of gaseous reactants or gaseous residues, e.g. cleaning
- 8/0668 Removal of carbon monoxide or carbon dioxide
- 8/0675 {Removal of sulfur}
- 8/0681 {Reactant purification by the use of electrochemical cells}
- 8/0687 {Reactant purification by the use of membranes or filters}
- 8/0693 {Treatment of the electrolyte residue, e.g. reconcentrating}
- 8/08 Fuel cells with aqueous electrolytes
- 8/083 Alkaline fuel cells
- 8/086 Phosphoric acid fuel cells [PAFC]
- 8/10 Fuel cells with solid electrolytes
- 8/1004 characterised by membrane-electrode assemblies [MEA] ([H01M 8/12](#) takes precedence)
- 8/1006 Corrugated, curved or wave-shaped MEA
- 8/1007 with both reactants being gaseous or vaporised ([H01M 8/12](#) takes precedence)
- 8/1009 with one of the reactants being liquid, solid or liquid-charged ([H01M 8/12](#) takes precedence)
- 8/1011 Direct alcohol fuel cells [DAFC], e.g. direct methanol fuel cells [DMFC]
- 8/1013 {Other direct alcohol fuel cells [DAFC]}
- 8/1016 characterised by the electrolyte material ([H01M 8/12](#) takes precedence)
- 8/1018 Polymeric electrolyte materials
- 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.
- 8/1023 having only carbon, e.g. polyarylenes, polystyrenes or polybutadiene-styrenes
- 8/1025 having only carbon and oxygen, e.g. polyethers, sulfonated polyetheretherketones [S-PEEK], sulfonated polysaccharides, sulfonated celluloses or sulfonated polyesters
- 8/1027 having carbon, oxygen and other atoms, e.g. sulfonated polyethersulfones [S-PES]
- 8/103 having nitrogen, e.g. sulfonated polybenzimidazoles [S-PBI], polybenzimidazoles with phosphoric acid, sulfonated polyamides [S-PA] or sulfonated polyphosphazenes [S-PPh]
- 8/1032 having sulfur, e.g. sulfonated-polyethersulfones [S-PES]
- 8/1034 having phosphorus, e.g. sulfonated polyphosphazenes [S-PPh]
- 8/1037 having silicon, e.g. sulfonated crosslinked polydimethylsiloxanes

- 8/1039 halogenated, e.g. sulfonated polyvinylidene fluorides
- 8/1041 Polymer electrolyte composites, mixtures or blends
- 8/1044 Mixtures of polymers, of which at least one is ionically conductive
- 8/1046 Mixtures of at least one polymer and at least one additive
- 8/1048 Ion-conducting additives, e.g. ion-conducting particles, heteropolyacids, metal phosphate or polybenzimidazole with phosphoric acid
- 8/1051 Non-ion-conducting additives, e.g. stabilisers, SiO₂ or ZrO₂
- 8/1053 consisting of layers of polymers with at least one layer being ionically conductive
- 8/1055 {Inorganic layers on the polymer electrolytes, e.g. inorganic coatings}
- 8/1058 characterised by a porous support having no ion-conducting properties
- 8/106 characterised by the chemical composition of the porous support
- 8/1062 characterised by the physical properties of the porous support, e.g. its porosity or thickness
- 8/1065 characterised by the form, e.g. perforated or wave-shaped
- 8/1067 characterised by their physical properties, e.g. porosity, ionic conductivity or thickness
- 8/1069 characterised by the manufacturing processes
- 8/1072 by chemical reactions, e.g. *in situ* polymerisation or *in situ* crosslinking
- 8/1074 {Sol-gel processes}
- 8/1076 {Micromachining techniques, e.g. masking, etching steps or photolithography}
- 8/1079 {Inducing porosity into non porous precursors membranes, e.g. leaching, pore stretching}
- 8/1081 starting from solutions, dispersions or slurries exclusively of polymers
- 8/1083 {Starting from polymer melts other than monomer melts}
- 8/1086 After-treatment of the membrane other than by polymerisation
- 8/1088 Chemical modification, e.g. sulfonation
- 8/109 {thermal other than drying, e.g. sintering}
- 8/1093 {mechanical, e.g. pressing, puncturing}
- 2008/1095 . . {Fuel cells with polymeric electrolytes}
- 8/1097 . . Fuel cells applied on a support, e.g. miniature fuel cells deposited on silica supports
- 8/12 . . operating at high temperature, e.g. with stabilised ZrO₂ electrolyte
- 8/1213 . . . characterised by the electrode/electrolyte combination or the supporting material
- 8/122 . . . Corrugated, curved or wave-shaped MEA
- 8/1226 . . . characterised by the supporting layer
- 8/1231 . . . with both reactants being gaseous or vaporised
- 8/1233 . . . with one of the reactants being liquid, solid or liquid-charged
- 8/124 . . . characterised by the process of manufacturing or by the material of the electrolyte
- 8/1246 . . . the electrolyte consisting of oxides
- 8/1253 the electrolyte containing zirconium oxide
- 8/126 the electrolyte containing cerium oxide
- 8/1266 {the electrolyte containing bismuth oxide}
- 8/1273 {Fuel cells with solid halide electrolytes}
- 2008/128 . . . {Fuel cells with solid halide electrolytes}
- 8/1286 . . . Fuel cells applied on a support, e.g. miniature fuel cells deposited on silica supports
- 2008/1293 . . . {Fuel cells with solid oxide electrolytes}
- 8/14 . . Fuel cells with fused electrolytes
- 8/141 . . {the anode and the cathode being gas-permeable electrodes or electrode layers}
- 8/142 . . . {with matrix-supported or semi-solid matrix-reinforced electrolyte}
- 8/143 . . {with liquid, solid or electrolyte-charged reactants}
- 8/144 . . {characterised by the electrolyte material}
- 8/145 . . . {comprising carbonates}
- 8/146 . . {Fuel cells with molten hydroxide}
- 2008/147 . . {Fuel cells with molten carbonates}
- 8/148 . . {Measures, other than selecting a specific electrode material, to reduce electrode dissolution}
- 8/16 . . Biochemical fuel cells, i.e. cells in which microorganisms function as catalysts
- 8/18 . . Regenerative fuel cells, e.g. redox flow batteries or secondary fuel cells
- 8/182 . . {Regeneration by thermal means}
- 8/184 . . {Regeneration by electrochemical means}
- 8/186 . . . {by electrolytic decomposition of the electrolytic solution or the formed water product}
- 8/188 . . . {by recharging of redox couples containing fluids; Redox flow type batteries}
- 8/20 . . Indirect fuel cells, e.g. fuel cells with redox couple being irreversible (H01M 8/18 takes precedence)
- 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
- 8/222 . . {Fuel cells in which the fuel is based on compounds containing nitrogen, e.g. hydrazine, ammonia}
- 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}
- 8/227 . . {Dialytic cells or batteries; Reverse electrodialysis cells or batteries}
- 8/24 . . Grouping of fuel cells, e.g. stacking of fuel cells
- 8/2404 . . Processes or apparatus for grouping fuel cells
- 8/241 . . with solid or matrix-supported electrolytes
- 8/2418 . . . Grouping by arranging unit cells in a plane (H01M 8/2425, H01M 8/244 take precedence)
- 8/242 . . . comprising framed electrodes or intermediary frame-like gaskets (H01M 8/2425, H01M 8/244 take precedence)
- 8/2425 . . . High-temperature cells with solid electrolytes
- 8/2428 Grouping by arranging unit cells on a surface of any form, e.g. planar or tubular
- 8/243 Grouping of unit cells of tubular or cylindrical configuration
- 8/2432 Grouping of unit cells of planar configuration

- 8/2435 with monolithic core structure, e.g. honeycombs
- 8/244 . . . with matrix-supported molten electrolyte
- 8/2455 . . with liquid, solid or electrolyte-charged reactants
- 8/2457 . . with both reactants being gaseous or vaporised
- 8/2459 . . {Comprising electrode layers with interposed electrolyte compartment with possible electrolyte supply or circulation}
- 8/2465 . . Details of groupings of fuel cells
- 8/247 . . . Arrangements for tightening a stack, for accommodation of a stack in a tank or for assembling different tanks
- 8/2475 Enclosures, casings or containers of fuel cell stacks
- 8/248 Means for compression of the fuel cell stacks
- 8/2483 . . . characterised by internal manifolds
- 8/2484 . . . characterised by external manifolds
- 8/2485 Arrangements for sealing external manifolds; Arrangements for mounting external manifolds around a stack
- 8/249 . . comprising two or more groupings of fuel cells, e.g. modular assemblies
- 8/2495 . . . of fuel cells of different types
- 10/00 Secondary cells; Manufacture thereof**
- NOTE**
- In this group, secondary cells are accumulators receiving and supplying electrical energy by means of reversible electrochemical reactions.
- 10/02 . Details (of electrodes [H01M 4/00](#); of non-active parts [H01M 50/00](#))
- 10/04 . Construction or manufacture in general ([H01M 10/058](#), [H01M 10/12](#), [H01M 10/28](#), [H01M 10/38](#) take precedence)
- 10/0404 . . {Machines for assembling batteries}
- 10/0409 . . . {for cells with wound electrodes}
- 10/0413 . . {Large-sized flat cells or batteries for motive or stationary systems with plate-like electrodes}
- 10/0418 . . . {with bipolar electrodes}
- 10/0422 . . {Cells or battery with cylindrical casing}
- 10/0427 . . . {Button cells}
- 10/0431 . . {Cells with wound or folded electrodes ([H01M 10/045](#) takes precedence)}
- 10/0436 . . {Small-sized flat cells or batteries for portable equipment}
- 10/044 . . . {with bipolar electrodes}
- 10/0445 . . {Multimode batteries, e.g. containing auxiliary cells or electrodes switchable in parallel or series connections}
- 10/045 . . {Cells or batteries with folded plate-like electrodes}
- 10/0454 . . . {Cells or batteries with electrodes of only one polarity folded}
- 10/0459 . . {Cells or batteries with folded separator between plate-like electrodes}
- 10/0463 . . {Cells or batteries with horizontal or inclined electrodes}
- 10/0468 . . {Compression means for stacks of electrodes and separators}
- 10/0472 . . {Vertically superposed cells with vertically disposed plates}
- 10/0477 . . {with circular plates}
- 10/0481 . . {Compression means other than compression means for stacks of electrodes and separators}
- 10/0486 . . {Frames for plates or membranes}
- 10/049 . . {Processes for forming or storing electrodes in the battery container}
- 2010/0495 . . {Nanobatteries}
- 10/05 . Accumulators with non-aqueous electrolyte ([H01M 10/39](#) takes precedence)
- 10/052 . . Li-accumulators
- 10/0525 . . . Rocking-chair batteries, i.e. batteries with lithium insertion or intercalation in both electrodes; Lithium-ion batteries
- 10/054 . . Accumulators with insertion or intercalation of metals other than lithium, e.g. with magnesium or aluminium
- 10/056 . . characterised by the materials used as electrolytes, e.g. mixed inorganic/organic electrolytes
- 10/0561 . . . the electrolyte being constituted of inorganic materials only
- 10/0562 Solid materials
- 10/0563 Liquid materials, e.g. for Li-SOCl₂ cells
- 10/0564 . . . the electrolyte being constituted of organic materials only
- 10/0565 Polymeric materials, e.g. gel-type or solid-type
- 10/0566 Liquid materials
- 10/0567 characterised by the additives
- 10/0568 characterised by the solutes
- 10/0569 characterised by the solvents
- 10/058 . . Construction or manufacture
- 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
- 10/0585 . . . of accumulators having only flat construction elements, i.e. flat positive electrodes, flat negative electrodes and flat separators
- 10/0587 . . . of accumulators having only wound construction elements, i.e. wound positive electrodes, wound negative electrodes and wound separators
- 10/06 . Lead-acid accumulators ([semi-lead accumulators H01M 10/20](#))
- 10/08 . . Selection of materials as electrolytes
- 10/10 . . . Immobilising of electrolyte
- 10/12 . . Construction or manufacture
- 10/121 . . . {Valve regulated lead acid batteries [VRLA]}
- 10/122 . . . {Multimode batteries}
- 10/123 . . . {Cells or batteries with cylindrical casing}
- 10/124 {Button cells}
- 10/125 . . . {Cells or batteries with wound or folded electrodes}
- 10/126 . . . {Small-sized flat cells or batteries for portable equipment ([H01M 10/123](#) and [H01M 10/125](#) take precedence)}
- 10/127 {with bipolar electrodes}
- 10/128 . . . {Processes for forming or storing electrodes in the battery container}
- 10/14 . . . Assembling a group of electrodes or separators
- 10/16 . . . Suspending or supporting electrodes or groups of electrodes in the case
- 10/18 . . with bipolar electrodes

- 10/20 . Semi-lead accumulators, i.e. accumulators in which only one electrode contains lead
- 10/22 . . Selection of materials as electrolytes
- 10/24 . Alkaline accumulators
- 10/26 . . Selection of materials as electrolytes
- 10/28 . . Construction or manufacture
- 10/281 . . . {Large cells or batteries with stacks of plate-like electrodes}
- 10/282 {with bipolar electrodes}
- 10/283 . . . {Cells or batteries with two cup-shaped or cylindrical collectors ([H01M 10/281 takes precedence](#))}
- 10/285 {Button cells}
- 10/286 . . . {Cells or batteries with wound or folded electrodes}
- 10/287 . . . {Small-sized flat cells or batteries for portable equipment ([H01M 10/283](#) and [H01M 10/286 take precedence](#))}
- 10/288 . . . {Processes for forming or storing electrodes in the battery container}
- 10/30 . . Nickel accumulators ([H01M 10/34 takes precedence](#))
- 10/32 . . Silver accumulators ([H01M 10/34 takes precedence](#))
- 10/34 . Gastight accumulators
- 10/342 . . {Gastight lead accumulators ([H01M 10/121 takes precedence](#))}
- 10/345 . . {Gastight metal hydride accumulators}
- 10/347 . . . {with solid electrolyte}
- 10/36 . Accumulators not provided for in groups [H01M 10/05-H01M 10/34](#)
- 10/365 . . {Zinc-halogen accumulators}
- 10/38 . . Construction or manufacture
- 10/39 . . working at high temperature
- 10/3909 . . . {Sodium-sulfur cells}
- 10/3918 {characterised by the electrolyte}
- 10/3927 {Several layers of electrolyte or coatings containing electrolyte}
- 10/3936 {Electrolyte with a shape other than plane or cylindrical}
- 10/3945 {containing additives or special arrangements in the sodium compartment}
- 10/3954 {containing additives or special arrangement in the sulfur compartment}
- 10/3963 {Sealing means between the solid electrolyte and holders}
- 10/3972 {Flexible parts}
- 10/3981 {Flat cells}
- 10/399 . . . {Cells with molten salts}
- 10/42 . Methods or arrangements for servicing or maintenance of secondary cells or secondary half-cells ([H01M 10/60 takes precedence](#))
- 10/4207 . . {for several batteries or cells simultaneously or sequentially}
- 10/4214 . . {Arrangements for moving electrodes or electrolyte}
- 10/4221 . . {with battery type recognition}
- 10/4228 . . {Leak testing of cells or batteries}
- 10/4235 . . {Safety or regulating additives or arrangements in electrodes, separators or electrolyte ([H01M 10/4242 takes precedence](#))}
- 10/4242 . . {Regeneration of electrolyte or reactants}
- 10/425 . . {Structural combination with electronic components, e.g. electronic circuits integrated to the outside of the casing ([printed circuits H05K 1/00](#))}
- 10/4257 {Smart batteries, e.g. electronic circuits inside the housing of the cells or batteries}
- 10/4264 {with capacitors}
- 2010/4271 {Battery management systems including electronic circuits, e.g. control of current or voltage to keep battery in healthy state, cell balancing}
- 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}
- 10/4285 . . {Testing apparatus}
- 2010/4292 . . {Aspects relating to capacity ratio of electrodes/electrolyte or anode/cathode}
- 10/44 . . Methods for charging or discharging ([circuits for charging H02J 7/00](#))
- 10/441 . . . {for several batteries or cells simultaneously or sequentially}
- 10/443 . . . {in response to temperature}
- 10/445 . . . {in response to gas pressure}
- 10/446 . . . {Initial charging measures}
- 10/448 . . . {End of discharge regulating measures}
- 10/46 . . Accumulators structurally combined with charging apparatus ([circuits for charging H02J 7/00](#))
- 10/465 . . . {with solar battery as charging system}
- 10/48 . . Accumulators combined with arrangements for measuring, testing or indicating the condition of cells, e.g. the level or density of the electrolyte ([constructional details of current conducting connections for detecting conditions inside cells or batteries, e.g. details of voltage sensing terminals, H01M 50/569](#))
- 10/482 . . . {for several batteries or cells simultaneously or sequentially}
- 10/484 . . . {for measuring electrolyte level, electrolyte density or electrolyte conductivity}
- 10/486 . . . {for measuring temperature}
- 10/488 . . . {Cells or batteries combined with indicating means for external visualization of the condition, e.g. by change of colour or of light density}
- 10/52 . . Removing gases inside the secondary cell, e.g. by absorption ([vent plugs or other mechanical arrangements for facilitating escape of gases H01M 50/30](#))
- 10/523 . . . {by recombination on a catalytic material}
- 10/526 . . . {by gas recombination on the electrode surface or by structuring the electrode surface to improve gas recombination}
- 10/54 . Reclaiming serviceable parts of waste accumulators
- 10/60 . Heating or cooling; Temperature control
- 10/61 . . Types of temperature control
- 10/613 . . . Cooling or keeping cold
- 10/615 . . . Heating or keeping warm
- 10/617 . . . for achieving uniformity or desired distribution of temperature
- 10/62 . . specially adapted for specific applications
- 10/623 . . . Portable devices, e.g. mobile telephones, cameras or pacemakers

- 10/6235 Power tools
- 10/625 . . . Vehicles
- 10/627 . . . Stationary installations, e.g. power plant buffering or backup power supplies
- 10/63 . . Control systems ([charging or discharging in response to temperature H01M 10/44](#) {, [H01M 10/443](#)}; measurement of temperature [H01M 10/48](#) {, [H01M 10/486](#)})
- 10/633 . . . characterised by algorithms, flow charts, software details or the like
- 10/635 . . . based on ambient temperature
- 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 ([means for preventing undesired use or discharge H01M 50/572](#))
- 10/64 . . characterised by the shape of the cells
- 10/643 . . . Cylindrical cells
- 10/647 . . . Prismatic or flat cells, e.g. pouch cells
- 10/65 . . Means for temperature control structurally associated with the cells
- 10/651 . . . characterised by parameters specified by a numeric value or mathematical formula, e.g. ratios, sizes or concentrations
- 10/652 characterised by gradients ([for achieving a desired temperature gradient H01M 10/617](#))
- 10/653 . . . characterised by electrically insulating or thermally conductive materials
- 10/654 . . . located inside the innermost case of the cells, e.g. mandrels, electrodes or electrolytes
- 10/655 . . . Solid structures for heat exchange or heat conduction
- 10/6551 Surfaces specially adapted for heat dissipation or radiation, e.g. fins or coatings
- 10/6552 Closed pipes transferring heat by thermal conductivity or phase transition, e.g. heat pipes
- 10/6553 Terminals or leads
- 10/6554 Rods or plates
- 10/6555 arranged between the cells
- 10/6556 Solid parts with flow channel passages or pipes for heat exchange ([closed pipes H01M 10/6552](#))
- 10/6557 arranged between the cells
- 10/656 . . . characterised by the type of heat-exchange fluid
- 10/6561 Gases
- 10/6562 with free flow by convection only
- 10/6563 with forced flow, e.g. by blowers
- 10/6564 using compressed gas
- 10/6565 with recirculation or U-turn in the flow path, i.e. back and forth
- 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](#))
- 10/6567 Liquids
- 10/6568 characterised by flow circuits, e.g. loops, located externally to the cells or cell casings
- 10/6569 Fluids undergoing a liquid-gas phase change or transition, e.g. evaporation or condensation ([heat pipes H01M 10/6552](#))
- 10/657 . . . by electric or electromagnetic means
- 10/6571 Resistive heaters ([arrangements for heating the battery by its resistance to the internal current H01M 10/637](#))
- 10/6572 Peltier elements or thermoelectric devices
- 10/658 . . . by thermal insulation or shielding
- 10/659 . . . by heat storage or buffering, e.g. heat capacity or liquid-solid phase changes or transition
- 10/6595 . . . by chemical reactions other than electrochemical reactions of the cells, e.g. catalytic heaters or burners
- 10/66 . . Heat-exchange relationships between the cells and other systems, e.g. central heating systems or fuel cells
- 10/663 . . . the system being an air-conditioner or an engine
- 10/667 . . . the system being an electronic component, e.g. a CPU, an inverter or a capacitor
- 12/00 Hybrid cells; Manufacture thereof (hybrid capacitors H01G 11/00)**
- NOTES**
1. This group does not cover hybrid cells comprising capacitor electrodes and battery electrodes, which are covered by group [H01G 11/00](#).
 2. In this group, 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.
- 12/02 . . Details ([of electrodes H01M 4/00](#); [of non-active parts H01M 50/00](#))
- 12/04 . . composed of a half-cell of the fuel-cell type and of a half-cell of the primary-cell type
- 12/06 . . with one metallic and one gaseous electrode
- 12/065 . . . {[with plate-like electrodes or stacks of plate-like electrodes](#)}
- 12/08 . . composed of a half-cell of a fuel-cell type and a half-cell of the secondary-cell type
- 12/085 . . {[Zinc-halogen cells or batteries](#)}
- 14/00 Electrochemical current or voltage generators not provided for in groups H01M 6/00 - H01M 12/00; Manufacture thereof**
- NOTE**
- This group does not cover solar cells, photocells, photoelectrochemical cells or photovoltaic cells, which are covered by the following groups:
- semiconductor devices sensitive to light and adapted for the conversion of the energy of such radiation into electrical energy are covered by group [H10F 10/00](#);
 - solid-state devices using organic materials as active part specially adapted for sensing light and adapted for the conversion of the energy of such radiation into electrical energy are covered by group [H10K 30/00](#);
 - electrolytic light-sensitive devices, e.g. dye-sensitised solar cells, are covered by group [H01G 9/20](#);
 - photovoltaic modules structurally associated with energy storage means, e.g. batteries, are covered by group [H02S 40/38](#).

- 14/005 . {Photoelectrochemical storage cells (light sensitive devices [H01G 9/20](#), semiconductors sensitive to light [H10F](#))}
- 16/00 Structural combinations of different types of electrochemical generators**
- 16/003 . {of fuel cells with other electrochemical devices, e.g. capacitors, electrolyzers}
- 16/006 . . {of fuel cells with rechargeable batteries}
- 50/00 Constructional details or processes of manufacture of the non-active parts of electrochemical cells other than fuel cells, e.g. hybrid cells**
- 50/10 . Primary casings; Jackets or wrappings
- 50/102 . . characterised by their shape or physical structure
- 50/103 . . . prismatic or rectangular ([H01M 50/109](#), [H01M 50/11](#) take precedence)
- 50/105 . . . Pouches or flexible bags
- 50/107 . . . having curved cross-section, e.g. round or elliptic ([H01M 50/103](#), [H01M 50/109](#), [H01M 50/11](#) take precedence)
- 50/109 . . . of button or coin shape
- 50/11 . . . having a chip structure, e.g. micro-sized batteries integrated on chips
- 50/112 . . . Monobloc comprising multiple compartments
- 50/114 . . . specially adapted for lead-acid cells
- 50/116 . . characterised by the material
- 50/117 . . . Inorganic material
- 50/119 Metals
- 50/121 . . . Organic material
- 50/122 . . . Composite material consisting of a mixture of organic and inorganic materials
- 50/124 . . . having a layered structure
- 50/1243 {characterised by the internal coating on the casing}
- 50/1245 {characterised by the external coating on the casing}
- 50/126 comprising three or more layers
- 50/128 with two or more layers of only inorganic material
- 50/129 with two or more layers of only organic material
- 50/131 . . characterised by physical properties, e.g. gas permeability, size or heat resistance
- 50/133 . . . Thickness
- 50/134 . . . Hardness
- 50/136 . . . Flexibility or foldability
- 50/138 . . adapted for specific cells, e.g. electrochemical cells operating at high temperature
- 50/1385 . . . {Hybrid cells}
- 50/14 . . for protecting against damage caused by external factors
- 50/141 . . . for protecting against humidity
- 50/143 . . . Fireproof; Explosion-proof
- 50/145 . . . for protecting against corrosion
- 50/147 . . Lids or covers
- 50/148 . . . characterised by their shape
- 50/15 for prismatic or rectangular cells ([H01M 50/153](#) takes precedence)
- 50/152 for cells having curved cross-section, e.g. round or elliptic ([H01M 50/15](#), [H01M 50/153](#) take precedence)
- 50/153 for button or coin cells
- 50/1535 {adapted for specific cells, e.g. electrochemical cells operating at high temperature}
- 50/1537 {for hybrid cells}
- 50/154 {Lid or cover comprising an axial bore for receiving a central current collector}
- 50/155 . . . characterised by the material
- 50/157 Inorganic material
- 50/159 Metals
- 50/16 Organic material
- 50/162 Composite material consisting of a mixture of organic and inorganic materials
- 50/164 having a layered structure
- 50/166 . . . characterised by the methods of assembling casings with lids
- 50/167 by crimping
- 50/169 by welding, brazing or soldering
- 50/171 using adhesives or sealing agents
- 50/172 . . Arrangements of electric connectors penetrating the casing
- 50/174 . . . adapted for the shape of the cells
- 50/176 for prismatic or rectangular cells ([H01M 50/181](#) takes precedence)
- 50/178 for pouch or flexible bag cells
- 50/179 for cells having curved cross-section, e.g. round or elliptic ([H01M 50/176](#), [H01M 50/181](#) take precedence)
- 50/181 for button or coin cells
- 50/182 {for cells with a collector centrally disposed in the active mass, e.g. Leclanché cells}
- 50/183 . . Sealing members
- 50/184 . . . characterised by their shape or structure
- 50/186 . . . characterised by the disposition of the sealing members
- 50/188 the sealing members being arranged between the lid and terminal
- 50/19 . . . characterised by the material
- 50/191 Inorganic material
- 50/193 Organic material
- 50/195 Composite material consisting of a mixture of organic and inorganic materials
- 50/197 having a layered structure
- 50/198 characterised by physical properties, e.g. adhesiveness or hardness
- 50/20 . . Mountings; Secondary casings or frames; Racks, modules or packs; Suspension devices; Shock absorbers; Transport or carrying devices; Holders ([structural combination of accumulators with charging apparatus \[H01M 10/46\]\(#\)](#))
- 50/202 . . Casings or frames around the primary casing of a single cell or a single battery
- 50/204 . . Racks, modules or packs for multiple batteries or multiple cells
- 50/207 . . . characterised by their shape
- 50/209 adapted for prismatic or rectangular cells ([H01M 50/216](#) takes precedence)
- 50/211 adapted for pouch cells
- 50/213 adapted for cells having curved cross-section, e.g. round or elliptic ([H01M 50/209](#), [H01M 50/216](#) take precedence)
- 50/216 adapted for button or coin cells
- 50/218 . . characterised by the material
- 50/22 . . . of the casings or racks

- 50/222 Inorganic material
- 50/224 Metals
- 50/227 Organic material
- 50/229 Composite material consisting of a mixture of organic and inorganic materials
- 50/231 having a layered structure
- 50/233 . . characterised by physical properties of casings or racks, e.g. dimensions
- 50/236 . . . Hardness
- 50/238 . . . Flexibility or foldability
- 50/24 . . . adapted for protecting batteries from their environment, e.g. from corrosion ([thermal insulation H01M 10/658](#))
- 50/242 . . . adapted for protecting batteries against vibrations, collision impact or swelling
- 50/244 . . Secondary casings; Racks; Suspension devices; Carrying devices; Holders characterised by their mounting method
- 50/247 . . specially adapted for portable devices, e.g. mobile phones, computers, hand tools or pacemakers
- 50/249 . . specially adapted for aircraft or vehicles, e.g. cars or trains ([constructional details of batteries specially adapted for electric vehicles B60L 50/64](#))
- 50/251 . . specially adapted for stationary devices, e.g. power plant buffering or backup power supplies
- 50/253 . . adapted for specific cells, e.g. electrochemical cells operating at high temperature
- 50/256 . . Carrying devices, e.g. belts
- 50/258 . . Modular batteries; Casings provided with means for assembling
- 50/26 . . . Assemblies sealed to each other in a non-detachable manner
- 50/262 . . with fastening means, e.g. locks
- 50/264 . . . for cells or batteries, e.g. straps, tie rods or peripheral frames
- 50/267 . . having means for adapting to batteries or cells of different types or different sizes
- 50/269 . . Mechanical means for varying the arrangement of batteries or cells for different uses, e.g. for changing the number of batteries or for switching between series and parallel wiring ([methods or arrangements for servicing or maintenance H01M 6/50, H01M 10/42](#))
- 50/271 . . Lids or covers for the racks or secondary casings
- 50/273 . . . characterised by the material
- 50/276 Inorganic material
- 50/278 Organic material
- 50/28 Composite material consisting of a mixture of organic and inorganic materials
- 50/282 having a layered structure
- 50/284 . . with incorporated circuit boards, e.g. printed circuit boards [PCB]
- 50/287 . . . Fixing of circuit boards to lids or covers
- 50/289 . . characterised by spacing elements or positioning means within frames, racks or packs ([spacing elements inside cells other than separators, membranes or diaphragms H01M 50/471](#))
- 50/291 . . . characterised by their shape
- 50/293 . . . characterised by the material
- 50/296 . . characterised by terminals of battery packs ([terminals of batteries H01M 50/543](#))
- 50/298 . . characterised by the wiring of battery packs
- 50/30 . . Arrangements for facilitating escape of gases
- 50/308 . . Detachable arrangements, e.g. detachable vent plugs or plug systems
- 50/317 . . Re-sealable arrangements
- 50/325 . . . comprising deformable valve members, e.g. elastic or flexible valve members
- 50/333 Spring-loaded vent valves
- 50/342 . . Non-re-sealable arrangements
- 50/3425 . . . {[in the form of rupturable membranes or weakened parts, e.g. pierced with the aid of a sharp member](#)}
- 50/35 . . Gas exhaust passages comprising elongated, tortuous or labyrinth-shaped exhaust passages
- 50/358 . . . External gas exhaust passages located on the battery cover or case
- 50/367 . . . Internal gas exhaust passages forming part of the battery cover or case; Double cover vent systems
- 50/375 . . Vent means sensitive to or responsive to temperature
- 50/383 . . Flame arresting or ignition-preventing means
- 50/392 . . with means for neutralising or absorbing electrolyte; with means for preventing leakage of electrolyte through vent holes
- 50/394 . . {[Gas-pervious parts or elements](#)}
- 50/40 . . Separators; Membranes; Diaphragms; Spacing elements inside cells
- 50/403 . . Manufacturing processes of separators, membranes or diaphragms
- 50/406 . . . Moulding; Embossing; Cutting
- 50/409 . . Separators, membranes or diaphragms characterised by the material
- 50/411 . . . Organic material
- 50/414 Synthetic resins, e.g. thermoplastics or thermosetting resins
- 50/417 Polyolefins
- 50/42 Acrylic resins
- 50/423 Polyamide resins
- 50/426 Fluorocarbon polymers
- 50/429 Natural polymers
- 50/4295 {[Natural cotton, cellulose or wood](#)}
- 50/431 . . . Inorganic material
- 50/434 Ceramics
- 50/437 Glass
- 50/44 . . . Fibrous material
- 50/443 . . . Particulate material
- 50/446 . . . Composite material consisting of a mixture of organic and inorganic materials
- 50/449 . . . having a layered structure
- 50/451 comprising layers of only organic material and layers containing inorganic material
- 50/454 comprising a non-fibrous layer and a fibrous layer superimposed on one another
- 50/457 comprising three or more layers
- 50/46 . . Separators, membranes or diaphragms characterised by their combination with electrodes
- 50/461 . . . {[with adhesive layers between electrodes and separators](#)}
- 50/463 . . Separators, membranes or diaphragms characterised by their shape
- 50/466 . . . U-shaped, bag-shaped or folded
- 50/469 . . . tubular or cylindrical

- 50/471 . . Spacing elements inside cells other than separators, membranes or diaphragms (for preventing incorrect contact inside or outside batteries [H01M 50/584](#)); Manufacturing processes thereof
- 50/474 . . . characterised by their position inside the cells
- 50/477 . . . characterised by their shape
- 50/48 . . . characterised by the material
- 50/483 Inorganic material
- 50/486 Organic material
- 50/489 . . Separators, membranes, diaphragms or spacing elements inside the cells, characterised by their physical properties, e.g. swelling degree, hydrophilicity or shut down properties
- 50/491 . . . Porosity
- 50/494 . . . Tensile strength
- 50/497 . . . Ionic conductivity
- 50/50 . . Current conducting connections for cells or batteries
- 50/502 . . Interconnectors for connecting terminals of adjacent batteries; Interconnectors for connecting cells outside a battery casing
- 50/503 . . . characterised by the shape of the interconnectors
- 50/505 . . . comprising a single busbar
- 50/507 . . . comprising an arrangement of two or more busbars within a container structure, e.g. busbar modules
- 50/509 . . . characterised by the type of connection, e.g. mixed connections
- 50/51 Connection only in series
- 50/512 Connection only in parallel
- 50/514 . . . Methods for interconnecting adjacent batteries or cells
- 50/516 by welding, soldering or brazing
- 50/517 by fixing means, e.g. screws, rivets or bolts
- 50/519 . . . comprising printed circuit boards [PCB]
- 50/521 . . . characterised by the material
- 50/522 Inorganic material
- 50/524 Organic material
- 50/526 having a layered structure
- 50/528 . . Fixed electrical connections, i.e. not intended for disconnection
- 50/529 . . . Intercell connections through partitions, e.g. in a battery casing
- 50/531 . . Electrode connections inside a battery casing
- 50/533 . . . characterised by the shape of the leads or tabs
- 50/534 . . . characterised by the material of the leads or tabs
- 50/536 . . . characterised by the method of fixing the leads to the electrodes, e.g. by welding
- 50/538 . . . Connection of several leads or tabs of wound or folded electrode stacks
- 50/54 . . . Connection of several leads or tabs of plate-like electrode stacks, e.g. electrode pole straps or bridges
- 50/541 for lead-acid accumulators
- 50/543 . . Terminals
- 50/545 . . . formed by the casing of the cells ([cup shaped terminals adapted for cells having curved cross-section H01M 50/56](#))
- 50/547 . . . characterised by the disposition of the terminals on the cells
- 50/548 on opposite sides of the cell
- 50/55 on the same side of the cell
- 50/552 . . . characterised by their shape
- 50/553 Terminals adapted for prismatic, pouch or rectangular cells
- 50/555 Window-shaped terminals
- 50/557 Plate-shaped terminals
- 50/559 Terminals adapted for cells having curved cross-section, e.g. round, elliptic or button cells ([H01M 50/553 takes precedence](#))
- 50/56 Cup shaped terminals
- 50/561 {[Hollow metallic terminals, e.g. terminal bushings](#)}
- 50/562 . . . characterised by the material
- 50/564 . . . characterised by their manufacturing process
- 50/566 by welding, soldering or brazing
- 50/567 by fixing means, e.g. screws, rivets or bolts
- 50/569 . . Constructional details of current conducting connections for detecting conditions inside cells or batteries, e.g. details of voltage sensing terminals ([battery terminal connectors with integrated measuring arrangements G01R 31/364](#))
- 50/571 . . Methods or arrangements for affording protection against corrosion; Selection of materials therefor
- 50/572 . . Means for preventing undesired use or discharge
- 50/574 . . . Devices or arrangements for the interruption of current
- 50/576 in response to theft
- 50/578 in response to pressure
- 50/579 in response to shock
- 50/581 in response to temperature
- 50/583 in response to current, e.g. fuses
- 50/584 . . . for preventing incorrect connections inside or outside the batteries
- 50/586 inside the batteries, e.g. incorrect connections of electrodes
- 50/588 outside the batteries, e.g. incorrect connections of terminals or busbars
- 50/59 characterised by the protection means
- 50/591 Covers
- 50/593 Spacers; Insulating plates
- 50/595 Tapes
- 50/597 Protection against reversal of polarity
- 50/598 . . . Guarantee labels
- 50/60 . . Arrangements or processes for filling or topping-up with liquids; Arrangements or processes for draining liquids from casings
- 50/609 . . Arrangements or processes for filling with liquid, e.g. electrolytes
- 50/618 . . . Pressure control
- 50/627 . . . Filling ports
- 50/636 Closing or sealing filling ports, e.g. using lids
- 50/645 Plugs
- 50/655 specially adapted for venting
- 50/664 Temporary seals, e.g. for storage of instant batteries or seawater batteries
- 50/668 . . {[Means for preventing spilling of liquid or electrolyte, e.g. when the battery is tilted or turned over](#)}
- 50/673 . . Containers for storing liquids; Delivery conduits therefor
- 50/682 . . . accommodated in battery or cell casings

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- 50/691 . . Arrangements or processes for draining liquids from casings; Cleaning battery or cell casings
- 50/70 . Arrangements for stirring or circulating the electrolyte
- 50/73 . . Electrolyte stirring by the action of gas on or in the electrolyte
- 50/77 . . with external circulating path
- 2200/00 Safety devices for primary or secondary batteries**
- 2200/10 . Temperature sensitive devices
- 2200/101 . . Bimetal
- 2200/103 . . Fuse
- 2200/105 . . NTC
- 2200/106 . . PTC
- 2200/108 . . Normal resistors
- 2200/20 . Pressure-sensitive devices
- 2200/30 . Preventing polarity reversal
- 2220/00 Batteries for particular applications**
- 2220/10 . Batteries in stationary systems, e.g. emergency power source in plant
- 2220/20 . Batteries in motive systems, e.g. vehicle, ship, plane
- 2220/30 . Batteries in portable systems, e.g. mobile phone, laptop
- 2250/00 Fuel cells for particular applications; Specific features of fuel cell system**
- 2250/10 . Fuel cells in stationary systems, e.g. emergency power source in plant
- 2250/20 . Fuel cells in motive systems, e.g. vehicle, ship, plane
- 2250/30 . Fuel cells in portable systems, e.g. mobile phone, laptop
- 2250/40 . Combination of fuel cells with other energy production systems
- 2250/402 . . Combination of fuel cell with other electric generators
- 2250/405 . . Cogeneration of heat or hot water
- 2250/407 . . Combination of fuel cells with mechanical energy generators
- 2300/00 Electrolytes**
- 2300/0002 . Aqueous electrolytes
- 2300/0005 . . Acid electrolytes
- 2300/0008 . . . Phosphoric acid-based
- 2300/0011 . . . Sulfuric acid-based
- 2300/0014 . . Alkaline electrolytes
- 2300/0017 . Non-aqueous electrolytes
- 2300/002 . . Inorganic electrolyte
- 2300/0022 . . . Room temperature molten salts
- 2300/0025 . . Organic electrolyte
- 2300/0028 . . . characterised by the solvent
- 2300/0031 Chlorinated solvents
- 2300/0034 Fluorinated solvents
- 2300/0037 Mixture of solvents
- 2300/004 Three solvents
- 2300/0042 Four or more solvents
- 2300/0045 . . . Room temperature molten salts comprising at least one organic ion
- 2300/0048 . . Molten electrolytes used at high temperature
- 2300/0051 . . . Carbonates
- 2300/0054 . . . Halogenides
- 2300/0057 Chlorides
- 2300/006 . . . Hydroxides
- 2300/0062 . . . Nitrates
- 2300/0065 . . Solid electrolytes
- 2300/0068 . . . inorganic
- 2300/0071 Oxides
- 2300/0074 Ion conductive at high temperature
- 2300/0077 based on zirconium oxide
- 2300/008 Halides
- 2300/0082 . . . Organic polymers
- 2300/0085 . Immobilising or gelification of electrolyte
- 2300/0088 . Composites
- 2300/0091 . . in the form of mixtures
- 2300/0094 . . in the form of layered products, e.g. coatings
- 2300/0097 . . . with adhesive layers