

## SECTION H — ELECTRICITY

### H01 BASIC ELECTRIC ELEMENTS

**H01M PROCESSES OR MEANS, e.g. BATTERIES, FOR THE DIRECT CONVERSION OF CHEMICAL ENERGY 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) [2]

#### Note(s)

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

#### Subclass index

#### CELLS ACCORDING TO TYPE

Primary cells.....	6/00
Fuel cells.....	8/00
Secondary cells.....	10/00
Hybrid cells; electrochemical generators not provided for otherwise; combinations of different types of electrochemical generators.....	12/00, 14/00, 16/00

#### DETAILS COMMON TO DIFFERENT TYPES OF CELLS

Details, processes of manufacture of the non-active parts.....	2/00
Electrodes.....	4/00

#### **2/00 Constructional details, or processes of manufacture, of the non-active parts [2]**

- 2/02 • Cases, jackets, or wrappings (working of plastics or substances in a plastic state B29) [2]
- 2/04 • • Lids or covers [2]
- 2/06 • • Arrangements for introducing electric connectors into or through cases [2]
- 2/08 • • Sealing materials [2]
- 2/10 • Mountings; Suspension devices; Shock absorbers; Transport or carrying devices; Holders (structural combination of accumulators with charging apparatus H01M 10/46) [2]
- 2/12 • Vent plugs or other mechanical arrangements for facilitating escape of gases [2]
- 2/14 • Separators; Membranes; Diaphragms; Spacing elements [2]
- 2/16 • • characterised by the material [2]
- 2/18 • • characterised by the shape [2]
- 2/20 • Current-conducting connections for cells [2]
- 2/22 • • Fixed connections, i.e. not intended for disconnection [2]
- 2/24 • • • Intercell connections through partitions, e.g. in a battery case [2]
- 2/26 • • • Electrode connections [2]
- 2/28 • • • for lead-acid accumulators [2]
- 2/30 • • Terminals [2]
- 2/32 • • Methods or arrangements for affording protection against corrosion; Selection of materials therefor [2]
- 2/34 • • with provision for preventing undesired use or discharge [2]
- 2/36 • Arrangements for filling, topping-up or emptying cases with or of liquid, e.g. for filling with electrolytes, for washing-out [2]

- 2/38 • Arrangements for moving electrolytes [2]

- 2/40 • • with external circulating path (H01M 8/04 takes precedence) [2]

#### **4/00 Electrodes** (electrodes for electrolytic processes C25) [2]

#### Note(s)

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.

- 4/02 • Electrodes composed of, or comprising, active material [2]
- 4/04 • • Processes of manufacture in general [2]
- 4/06 • • Electrodes for primary cells [2]
- 4/08 • • • Processes of manufacture [2]
- 4/10 • • • • of pressed electrodes with central core, i.e. dollies [2]
- 4/12 • • • • of consumable metal or alloy electrodes (use of alloy compositions as active materials H01M 4/38) [2]
- 4/13 • • Electrodes for accumulators with non-aqueous electrolyte, e.g. for lithium-accumulators; Processes of manufacture thereof [2010.01]

#### Note(s) [2010.01]

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 [2010.01]

- 4/1315 • • • • containing halogen atoms, e.g. LiCoOxFy **[2010.01]**
- 4/133 • • • Electrodes based on carbonaceous material, e.g. graphite-intercalation compounds or CFx **[2010.01]**
- 4/134 • • • Electrodes based on metals, Si or alloys **[2010.01]**
- 4/136 • • • Electrodes based on inorganic compounds other than oxides or hydroxides, e.g. sulfides, selenides, tellurides, halogenides or LiCoFy **[2010.01]**
- 4/137 • • • Electrodes based on electro-active polymers **[2010.01]**
- 4/139 • • • Processes of manufacture **[2010.01]**
- 4/1391 • • • • of electrodes based on mixed oxides or hydroxides, or on mixtures of oxides or hydroxides, e.g. LiCoOx **[2010.01]**
- 4/13915 • • • • • containing halogen atoms, e.g. LiCoOxFy **[2010.01]**
- 4/1393 • • • • of electrodes based on carbonaceous material, e.g. graphite-intercalation compounds or CFx **[2010.01]**
- 4/1395 • • • • of electrodes based on metals, Si or alloys **[2010.01]**
- 4/1397 • • • • of electrodes based on inorganic compounds other than oxides or hydroxides, e.g. sulfides, selenides, tellurides, halogenides or LiCoFy **[2010.01]**
- 4/1399 • • • • of electrodes based on electro-active polymers **[2010.01]**
- 4/14 • • Electrodes for lead-acid accumulators **[2]**
- 4/16 • • • Processes of manufacture **[2]**
- 4/18 • • • • of Plante electrodes **[2]**
- 4/20 • • • • of pasted electrodes **[2]**
- 4/21 • • • • • Drying of pasted electrodes **[2]**
- 4/22 • • • • Forming of electrodes **[2]**
- 4/23 • • • • • Drying or preserving electrodes after forming **[2]**
- 4/24 • • Electrodes for alkaline accumulators **[2]**
- 4/26 • • • Processes of manufacture **[2]**
- 4/28 • • • • Precipitating active material on the carrier **[2]**
- 4/29 • • • • • by electrochemical methods **[2]**
- 4/30 • • • • Pressing **[2]**
- 4/32 • • • Nickel oxide or hydroxide electrodes **[2]**
- 4/34 • • • Silver oxide or hydroxide electrodes **[2]**
- 4/36 • • Selection of substances as active materials, active masses, active liquids **[2]**
- 4/38 • • • of elements or alloys **[2]**
- 4/40 • • • • Alloys based on alkali metals **[2]**
- 4/42 • • • • Alloys based on zinc **[2]**
- 4/44 • • • • Alloys based on cadmium **[2]**
- 4/46 • • • • Alloys based on magnesium or aluminium **[2]**
- 4/48 • • • of inorganic oxides or hydroxides **[2, 2010.01]**
- 4/485 • • • • of mixed oxides or hydroxides for inserting or intercalating light metals, e.g. LiTi<sub>2</sub>O<sub>4</sub> or LiTi<sub>2</sub>OxFy (H01M 4/505, H01M 4/525 take precedence) **[2010.01]**
- 4/50 • • • • of manganese **[2, 2010.01]**
- 4/505 • • • • • of mixed oxides or hydroxides containing manganese for inserting or intercalating light metals, e.g. LiMn<sub>2</sub>O<sub>4</sub> or LiMn<sub>2</sub>OxFy **[2010.01]**
- 4/52 • • • • of nickel, cobalt or iron **[2, 2010.01]**
- 4/525 • • • • • of mixed oxides or hydroxides containing iron, cobalt or nickel for inserting or intercalating light metals, e.g. LiNiO<sub>2</sub>, LiCoO<sub>2</sub> or LiCoOxFy **[2010.01]**
- 4/54 • • • • of silver **[2]**
- 4/56 • • • • of lead **[2]**
- 4/57 • • • • • of "grey lead", i.e. powders containing lead and lead oxide **[2]**
- 4/58 • • • of inorganic compounds other than oxides or hydroxides, e.g. sulfides, selenides, tellurides, halogenides or LiCoFy **[2, 2010.01]**
- 4/583 • • • • Carbonaceous material, e.g. graphite-intercalation compounds or CFx **[2010.01]**
- 4/587 • • • • • for inserting or intercalating light metals **[2010.01]**
- 4/60 • • • of organic compounds **[2]**
- 4/62 • • Selection of inactive substances as ingredients for active masses, e.g. binders, fillers **[2]**
- 4/64 • • Carriers or collectors **[2]**
- 4/66 • • • Selection of materials **[2]**
- 4/68 • • • • for use in lead-acid accumulators **[2]**
- 4/70 • • • characterised by shape or form **[2]**
- 4/72 • • • • Grids **[2]**
- 4/73 • • • • • for lead-acid accumulators, e.g. frame plates **[2]**
- 4/74 • • • • • Meshes or woven material; Expanded metal **[2]**
- 4/75 • • • • Wires, rods, or strips **[2]**
- 4/76 • • • • Containers for holding the active material, e.g. tubes, capsules **[2]**
- 4/78 • • • • Shapes other than plane or cylindrical, e.g. helical **[2]**
- 4/80 • • • • Porous plates, e.g. sintered carriers **[2]**
- 4/82 • • • Multi-step processes for manufacturing carriers for lead-acid accumulators (single-step processes, see the relevant subclasses, e.g. B21D, B22D) **[2]**
- 4/84 • • • • involving casting **[2]**
- 4/86 • Inert electrodes with catalytic activity, e.g. for fuel cells **[2]**
- 4/88 • • Processes of manufacture **[2]**
- 4/90 • • Selection of catalytic material **[2]**
- 4/92 • • • Metals of platinum group (H01M 4/94 takes precedence) **[2]**
- 4/94 • • Non-porous diffusion electrodes, e.g. palladium membranes, ion exchange membranes **[2]**
- 4/96 • • Carbon-based electrodes **[2]**
- 4/98 • • Raney-type electrodes **[2]**
- 6/00 Primary cells; Manufacture thereof [2]**
- Note(s)**
- In this group, primary cells are electrochemical generators in which the cell energy is present in chemical form and is not regenerated.
- 6/02 • Details (of non-active parts H01M 2/00, of electrodes H01M 4/00) **[2]**
- 6/04 • Cells with aqueous electrolyte **[2]**
- 6/06 • • Dry cells, i.e. cells wherein the electrolyte is rendered non-fluid **[2]**
- 6/08 • • • with cup-shaped electrodes **[2]**
- 6/10 • • • with wound or folded electrodes **[2]**
- 6/12 • • • with flat electrodes **[2]**
- 6/14 • Cells with non-aqueous electrolyte **[2]**
- 6/16 • • with organic electrolyte (H01M 6/18 takes precedence) **[2]**

- 6/18 • • with solid electrolyte [2]
- 6/20 • • • working at high temperature (deferred-action thermal cells H01M 6/36) [2]
- 6/22 • Immobilising of electrolyte [2]
- 6/24 • Cells comprising two different electrolytes [2]
- 6/26 • Cells without oxidising active material, e.g. Volta cells [2]
- 6/28 • Standard cells, e.g. Weston cells [2]
- 6/30 • Deferred-action cells [2]
- 6/32 • • activated through external addition of electrolyte or of electrolyte components [2]
- 6/34 • • • Immersion cells, e.g. sea-water cells [2]
- 6/36 • • containing electrolyte and made operational by physical means, e.g. thermal cells (thermoelectric solid state devices H01L 35/00, H01L 37/00) [2]
- 6/38 • • • by mechanical means [2]
- 6/40 • Printed batteries [2]
- 6/42 • Grouping of primary cells into batteries (H01M 6/40 takes precedence) [2]
- 6/44 • • of tubular or cup-shaped cells [2]
- 6/46 • • of flat cells [2]
- 6/48 • • • with bipolar electrodes [2]
- 6/50 • Methods or arrangements for servicing or maintenance, e.g. maintaining operating temperature [2]
- 6/52 • Reclaiming serviceable parts of waste cells or batteries [2]
- 8/00 Fuel cells; Manufacture thereof [2]**
- Note(s)**  
In this group, fuel cells are electrochemical generators wherein the reactants are supplied from outside.
- 8/02 • Details (of non-active parts H01M 2/00, of electrodes H01M 4/00) [2]
- 8/04 • Auxiliary arrangements or processes, e.g. for control of pressure, for circulation of fluids [2]
- 8/06 • Combination of fuel cell with means for production of reactants or for treatment of residues (regenerative fuel cells H01M 8/18; production of reactants per se, see sections B or C) [2]
- 8/08 • Fuel cells with aqueous electrolytes [2]
- 8/10 • Fuel cells with solid electrolytes [2]
- 8/12 • • operating at high temperature, e.g. with stabilised ZrO<sub>2</sub> electrolyte [2]
- 8/14 • Fuel cells with fused electrolytes [2]
- 8/16 • Biochemical fuel cells, i.e. cells in which micro-organisms function as catalysts [2]
- 8/18 • Regenerative fuel cells [2]
- 8/20 • Indirect fuel cells, e.g. redox cells (H01M 8/18 takes precedence) [2]
- 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 [2]
- 8/24 • Grouping of fuel cells into batteries, e.g. modules [2]
- 10/00 Secondary cells; Manufacture thereof [2]**
- Note(s)**  
In this group, secondary cells are accumulators receiving and supplying electrical energy by means of reversible electrochemical reactions.
- 10/02 • Details (of non-active parts H01M 2/00, of electrodes H01M 4/00) [2]
- 10/04 • Construction or manufacture in general (H01M 10/12, H01M 10/28, H01M 10/38 take precedence) [2]
- 10/05 • Accumulators with non-aqueous electrolyte (H01M 10/39 takes precedence) [2010.01]
- 10/052 • • Li-accumulators [2010.01]
- 10/0525 • • • Rocking-chair batteries, i.e. batteries with lithium insertion or intercalation in both electrodes; Lithium-ion batteries [2010.01]
- 10/054 • • Accumulators with insertion or intercalation of metals other than lithium, e.g. with magnesium or aluminium [2010.01]
- 10/056 • • characterised by the materials used as electrolytes, e.g. mixed inorganic/organic electrolytes [2010.01]
- 10/0561 • • • the electrolyte being constituted of inorganic materials only [2010.01]
- 10/0562 • • • • Solid materials [2010.01]
- 10/0563 • • • • Liquid materials, e.g. for Li-SOCl<sub>2</sub> cells [2010.01]
- 10/0564 • • • the electrolyte being constituted of organic materials only [2010.01]
- 10/0565 • • • • Polymeric materials, e.g. gel-type or solid-type [2010.01]
- 10/0566 • • • • Liquid materials [2010.01]
- 10/0567 • • • • • characterised by the additives [2010.01]
- 10/0568 • • • • • characterised by the solutes [2010.01]
- 10/0569 • • • • • characterised by the solvents [2010.01]
- 10/058 • • Construction or manufacture [2010.01]
- 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 [2010.01]
- 10/0585 • • • of accumulators having only flat construction elements, i.e. flat positive electrodes, flat negative electrodes and flat separators [2010.01]
- 10/0587 • • • of accumulators having only wound construction elements, i.e. wound positive electrodes, wound negative electrodes and wound separators [2010.01]
- 10/06 • Lead-acid accumulators (semi-lead accumulators H01M 10/20) [2]
- 10/08 • Selection of materials as electrolytes [2]
- 10/10 • • Immobilising of electrolyte [2]
- 10/12 • • Construction or manufacture [2]
- 10/14 • • • Assembling a group of electrodes or separators [2]
- 10/16 • • • Suspending or supporting electrodes or groups of electrodes in the case [2]
- 10/18 • • with bipolar electrodes [2]
- 10/20 • Semi-lead accumulators, i.e. accumulators in which only one electrode contains lead [2]
- 10/22 • • Selection of materials as electrolytes [2]
- 10/24 • Alkaline accumulators [2]
- 10/26 • • Selection of materials as electrolytes [2]
- 10/28 • • Construction or manufacture [2]
- 10/30 • • Nickel accumulators (H01M 10/34 takes precedence) [2]
- 10/32 • • Silver accumulators (H01M 10/34 takes precedence) [2]
- 10/34 • Gastight accumulators [2]
- 10/36 • Accumulators not provided for in groups H01M 10/05-H01M 10/34 [2, 2010.01]
- 10/38 • • Construction or manufacture [2]

## H01M

- 10/39 • • working at high temperature [2]
- 10/42 • Methods or arrangements for servicing or maintenance of secondary cells or secondary half-cells (H01M 10/60 takes precedence) [2]
- 10/44 • • Methods for charging or discharging (circuits for charging H02J 7/00) [2]
- 10/46 • • Accumulators structurally combined with charging apparatus (circuits for charging H02J 7/00) [2]
- 10/48 • • Accumulators combined with arrangements for measuring, testing, or indicating condition, e.g. level or density of the electrolyte (indicating or measuring level of liquid in general G01F 23/00; measuring density G01N, e.g. G01N 9/00; measuring electric variables G01R) [2]
- 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) [2]
- 10/54 • Reclaiming serviceable parts of waste accumulators [2]
- 10/60 • Heating or cooling; Temperature control [2014.01]
- 10/61 • • Types of temperature control [2014.01]
- 10/613 • • • Cooling or keeping cold [2014.01]
- 10/615 • • • Heating or keeping warm [2014.01]
- 10/617 • • • for achieving uniformity or desired distribution of temperature [2014.01]
- 10/62 • • specially adapted for specific applications [2014.01]
- 10/623 • • • Portable devices, e.g. mobile telephones, cameras or pacemakers [2014.01]
- 10/6235 • • • • Power tools [2014.01]
- 10/625 • • • Vehicles [2014.01]
- 10/627 • • • Stationary installations, e.g. power plant buffering or backup power supplies [2014.01]
- 10/63 • • Control systems (measurement of temperature H01M 10/48; charging or discharging in response to temperature H01M 10/44) [2014.01]
- 10/633 • • • characterised by algorithms, flow charts, software details or the like [2014.01]
- 10/635 • • • based on ambient temperature [2014.01]
- 10/637 • • • characterised by the use of reversible temperature-sensitive devices, e.g. NTC, PTC or bimetal devices; characterised by control of the internal current flowing through the cells, e.g. by switching (H01M 2/34 takes precedence) [2014.01]
- 10/64 • • characterised by the shape of the cells [2014.01]
- 10/643 • • • Cylindrical cells [2014.01]
- 10/647 • • • Prismatic or flat cells, e.g. pouch cells [2014.01]
- 10/65 • • Means for temperature control structurally associated with the cells [2014.01]
- 10/651 • • • characterised by parameters specified by a numeric value or mathematical formula, e.g. ratios, sizes or concentrations [2014.01]
- 10/652 • • • • characterised by gradients (for achieving a desired temperature gradient H01M 10/617) [2014.01]
- 10/653 • • • characterised by electrically insulating or thermally conductive materials [2014.01]
- 10/654 • • • located inside the innermost case of the cells, e.g. mandrels, electrodes or electrolytes [2014.01]
- 10/655 • • • Solid structures for heat exchange or heat conduction [2014.01]
- 10/6551 • • • • Surfaces specially adapted for heat dissipation or radiation, e.g. fins or coatings [2014.01]
- 10/6552 • • • • Closed pipes transferring heat by thermal conductivity or phase transition, e.g. heat pipes [2014.01]
- 10/6553 • • • • Terminals or leads [2014.01]
- 10/6554 • • • • Rods or plates [2014.01]
- 10/6555 • • • • arranged between the cells [2014.01]
- 10/6556 • • • • Solid parts with flow channel passages or pipes for heat exchange (closed pipes H01M 10/6552) [2014.01]
- 10/6557 • • • • • arranged between the cells [2014.01]
- 10/656 • • • characterised by the type of heat-exchange fluid [2014.01]
- 10/6561 • • • • Gases [2014.01]
- 10/6562 • • • • • with free flow by convection only [2014.01]
- 10/6563 • • • • • with forced flow, e.g. by blowers [2014.01]
- 10/6564 • • • • • using compressed gas [2014.01]
- 10/6565 • • • • • with recirculation or U-turn in the flow path, i.e. back and forth [2014.01]
- 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) [2014.01]
- 10/6567 • • • • Liquids [2014.01]
- 10/6568 • • • • • characterised by flow circuits, e.g. loops, located externally to the cells or cell casings [2014.01]
- 10/6569 • • • • Fluids undergoing a liquid-gas phase change or transition, e.g. evaporation or condensation (heat pipes H01M 10/6552) [2014.01]
- 10/657 • • • • by electric or electromagnetic means [2014.01]
- 10/6571 • • • • Resistive heaters (arrangements for heating the battery by its resistance to the internal current H01M 10/637) [2014.01]
- 10/6572 • • • • Peltier elements or thermoelectric devices [2014.01]
- 10/658 • • • • by thermal insulation or shielding [2014.01]
- 10/659 • • • • by heat storage or buffering, e.g. heat capacity or liquid-solid phase changes or transition [2014.01]
- 10/6595 • • • • by chemical reactions other than electrochemical reactions of the cells, e.g. catalytic heaters or burners [2014.01]
- 10/66 • • Heat-exchange relationships between the cells and other systems, e.g. central heating systems or fuel cells [2014.01]
- 10/663 • • • the system being an air-conditioner or an engine [2014.01]
- 10/667 • • • the system being an electronic component, e.g. a CPU, an inverter or a capacitor [2014.01]
- 12/00 • Hybrid cells; Manufacture thereof [2]
- 12/00 • Note(s)  
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 non-active parts H01M 2/00, of electrodes H01M 4/00) [2]

- |       |  |       |   |
|-------|--|-------|---|
| 12/04 | <ul style="list-style-type: none"><li>• 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) [2]</li></ul>                   | 14/00 | <b>Electrochemical current or voltage generators not provided for in groups H01M 6/00-H01M 12/00; Manufacture thereof [2]</b> |
| 12/06 | <ul style="list-style-type: none"><li>• • with one metallic and one gaseous electrode [2]</li></ul>  | 16/00 | <b>Structural combinations of different types of electrochemical generators [2]</b>   |
| 12/08 | <ul style="list-style-type: none"><li>• 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) [2]</li></ul> |       |   |