

**CPC****COOPERATIVE PATENT CLASSIFICATION****H01G**

**CAPACITORS; CAPACITORS, RECTIFIERS, DETECTORS, SWITCHING DEVICES OR LIGHT-SENSITIVE DEVICES, OF THE ELECTROLYTIC TYPE** (selection of specified materials as dielectric [H01B 3/00](#); {ceramics [C04B](#)})

**H01G 2/00**

**Details of capacitors not covered by a single one of groups [H01G 4/00](#)-[H01G 11/00](#)**

[H01G 2/02](#)

. Mountings

[H01G 2/04](#)

.. specially adapted for mounting on a chassis

[H01G 2/06](#)

.. specially adapted for mounting on a printed-circuit support

[H01G 2/065](#)

... { for surface mounting, e.g. chip capacitors }

[H01G 2/08](#)

. Cooling arrangements; Heating arrangements; Ventilating arrangements

[H01G 2/10](#)

. Housing; Encapsulation { **WARNING: Not complete, see also [H01G 4/224](#)** }

[H01G 2/103](#)

.. { Sealings, e.g. for lead-in wires; Covers }

[H01G 2/106](#)

.. { Fixing the capacitor in a housing }

[H01G 2/12](#)

. Protection against corrosion ([H01G 2/10](#) takes precedence)

[H01G 2/14](#)

. Protection against electric or thermal overload (by cooling [H01G 2/08](#))

[H01G 2/16](#)

.. with fusing elements

[H01G 2/18](#)

.. with breakable contacts

[H01G 2/20](#)

. Arrangements for preventing discharge from edges of electrodes

[H01G 2/22](#)

. Electrostatic or magnetic shielding

[H01G 2/24](#)

. Distinguishing marks, e.g. colour coding

**H01G 4/00**

**Fixed capacitors; Processes of their manufacture** (electrolytic capacitors [H01G 9/00](#))

[H01G 4/002](#)

. Details

[H01G 4/005](#)

.. Electrodes

[H01G 4/008](#)

... Selection of materials

[H01G 4/0085](#)

.... { Fried electrodes }

[H01G 4/01](#)

... Form of self-supporting electrodes

[H01G 4/012](#)

... Form of non-self-supporting electrodes

[H01G 4/015](#)

... Special provisions for self-healing

[H01G 4/018](#)

.. Dielectrics

[H01G 4/02](#)

... Gas or vapour dielectrics

[H01G 4/04](#)

... Liquid dielectrics

[H01G 4/06](#)

... Solid dielectrics

[H01G 4/08](#)

.... Inorganic dielectrics

[H01G 4/085](#)

..... { Vapour deposited }

[H01G 4/10](#)

..... Metal-oxide dielectrics { ([H01G 4/085](#) takes precedence) }

[H01G 4/105](#)

..... { Glass dielectric }

H01G 4/12	.....	Ceramic dielectrics {(H01G 4/085 takes precedence; ceramic materials per se C04B 35/00)}
H01G 4/1209	.....	{characterised by the ceramic dielectric material (H01G 4/1272, H01G 4/1281 take precedence)}
H01G 4/1218	.....	{based on titanium oxides or titanates (H01G 4/1245 takes precedence)}
H01G 4/1227	.....	{ based on alkaline earth titanates}
H01G 4/1236	.....	{based on zirconium oxides or zirconates (H01G 4/1263 takes precedence)}
H01G 4/1245	.....	{containing also titanates}
H01G 4/1254	.....	{based on niobium or tungsten, tantalum oxides or niobates, tantalates}
H01G 4/1263	.....	{containing also zirconium oxides or zirconates}
H01G 4/1272	.....	{Semiconductive ceramic capacitors}
H01G 4/1281	.....	{with grain boundary layer}
H01G 4/129	.....	{containing a glassy phase, e.g. glass ceramic}
H01G 4/14	....	Organic dielectrics
H01G 4/145	.....	{vapour deposited}
H01G 4/16	.....	of fibrous material, e.g. paper
H01G 4/18	.....	of synthetic material, e.g. derivatives of cellulose (H01G 4/16 takes precedence)
H01G 4/183	.....	{Derivatives of cellulose (H01G 4/145 takes precedence)}
H01G 4/186	.....	{halogenated (H01G 4/145 takes precedence)}
H01G 4/20	...	using combinations of dielectrics from more than one of groups H01G 4/02 to H01G 4/06 (H01G 4/12 takes precedence)
H01G 4/203	....	{ Fibrous material or synthetic material}
H01G 4/206	....	{inorganic and synthetic material}
H01G 4/22	....	impregnated
H01G 4/221	.....	{ characterised by the composition of the impregnant}
H01G 4/222	.....	{ halogenated}
H01G 4/224	..	Housing; Encapsulation
H01G 4/228	..	Terminals
H01G 4/232	...	electrically connecting two or more layers of a stacked or rolled capacitor
H01G 4/2325	....	{ characterised by the material of the terminals}
H01G 4/236	...	leading through the housing, i.e. lead-through
H01G 4/242	...	the capacitive element surrounding the terminal
H01G 4/245	....	Tabs between the layers of a rolled electrode
H01G 4/248	...	the terminals embracing or surrounding the capacitive element, e.g. caps (H01G 4/252 takes precedence)
H01G 4/252	...	the terminals being coated on the capacitive element (H01G 4/232 takes precedence)
H01G 4/255	..	Means for correcting the capacitance value

- H01G 4/258 .. Temperature compensation means
  - H01G 4/26 . Folded capacitors
  - H01G 4/28 . Tubular capacitors
  - H01G 4/30 . Stacked capacitors ([H01G 4/33](#) takes precedence)
  - H01G 4/302 .. {obtained by injection of metal in cavities formed in a ceramic body}
  - H01G 4/304 .. {obtained from a another capacitor}
  - H01G 4/306 .. {made by thin film techniques}
  - H01G 4/308 .. {made by transfer techniques}
  - H01G 4/32 . Wound capacitors
  - H01G 4/33 . Thin- or thick-film capacitors (thin- or thick-film circuits [H01L 27/00](#){ capacitors without a potential-jump or surface barrier specially adapted for integrated circuits, details thereof, multistep manufacturing processes therefor [H01L 28/40](#)})
  - H01G 4/35 . Feed-through capacitors or anti-noise capacitors
  - H01G 4/38 . Multiple capacitors, i.e. structural combinations of fixed capacitors
  - H01G 4/385 .. {Single unit multiple capacitors, e.g. dual capacitor in one coil}
  - H01G 4/40 . Structural combinations of fixed capacitors with other electric elements, the structure mainly consisting of a capacitor, e.g. RC combinations (thin or thick film circuits [H01L 27/00](#); { capacitors without a potential-jump or surface barrier specially adapted for integrated circuits, details thereof, multistep manufacturing processes therefor [H01L 28/40](#)})
- H01G 5/00 Capacitors in which the capacitance is varied by mechanical means, e.g. by turning a shaft; Processes of their manufacture**
- H01G 5/01 . Details
  - H01G 5/011 .. Electrodes
  - H01G 5/012 ... at least one of the electrodes being a displaceable liquid or powder
  - H01G 5/013 .. Dielectrics
  - H01G 5/0132 ... { Liquid dielectrics}
  - H01G 5/0134 ... { Solid dielectrics}
  - H01G 5/0136 .... { with movable electrodes}
  - H01G 5/0138 .... { with movable dielectrics}
  - H01G 5/014 .. Housing; Encapsulation
  - H01G 5/015 .. Current collectors
  - H01G 5/017 .. Temperature compensation
  - H01G 5/019 .. Means for correcting the capacitance characteristics
  - H01G 2005/02 . {IPC5 having air, gas, or vacuum as the dielectric }
  - H01G 5/04 . using variation of effective area of electrode
  - H01G 5/06 .. due to rotation of flat or substantially flat electrodes
  - H01G 5/08 ... becoming active in succession
  - H01G 5/10 .. due to rotation of helical electrodes
  - H01G 5/12 .. due to rotation of part-cylindrical, conical, or spherical electrodes
  - H01G 5/14 .. due to longitudinal movement of electrodes

- H01G 5/145 . . . { with profiled electrodes}
- H01G 5/16 . using variation of distance between electrodes
- H01G 5/18 . . due to change in inclination, e.g. by flexing, by spiral wrapping
- H01G 5/38 . Multiple capacitors, e.g. ganged
- H01G 5/40 . Structural combinations of variable capacitors with other electric elements not covered by this subclass, the structure mainly consisting of a capacitor, e.g. RC combinations (RC-filters [H03H](#))

**H01G 7/00 Capacitors in which the capacitance is varied by non-mechanical means; Processes of their manufacture** (capacitors with potential jump or surface barrier [H01L 29/00](#))

- H01G 7/02 . Electrets, i.e. having a permanently-polarised dielectric
- H01G 7/021 . . {having an organic dielectric}
- H01G 7/023 . . . {of macromolecular compounds}
- H01G 7/025 . . {having an inorganic dielectric}
- H01G 7/026 . . . {with ceramic dielectric}
- H01G 7/028 . . {having a heterogeneous dielectric}
- H01G 7/04 . having a dielectric selected for the variation of its permittivity with applied temperature
- H01G 7/06 . having a dielectric selected for the variation of its permittivity with applied voltage, i.e. ferroelectric capacitors (electrets [H01G 7/02](#))

**H01G 9/00 Electrolytic capacitors, rectifiers, detectors, switching devices, light-sensitive or temperature-sensitive devices; Processes of their manufacture**

- H01G 9/0003 . {Protection against electric or thermal overload; cooling arrangements; means for avoiding the formation of cathode films ([H01G 9/12](#) takes precedence)}
- H01G 2009/0007 . {Double layer capacitors}
- H01G 2009/001 . {Temperature sensitive devices}
- H01G 2009/0014 . {Solid electrolytic capacitors}
- H01G 2009/0018 . . {with wound foil electrodes}
- H01G 2009/0021 . . {Skin fibre}
- H01G 2009/0025 . {Liquid electrolytic capacitors}
- H01G 9/0029 . { Processes of manufacture}
- H01G 9/0032 . . { formation of the dielectric layer (anodisation in general [C25D](#))}
- H01G 9/0036 . . { Formation of the solid electrolyte layer}
- H01G 9/004 . Details
- H01G 9/008 . . Terminals
- H01G 9/012 . . . specially adapted for solid capacitors
- H01G 9/016 . . . specially adapted for double-layer capacitors
- H01G 9/02 . . Diaphragms; Separators
- H01G 9/022 . . Electrolytes, absorbents (electrolytic or electrophoretic processes, apparatus therefor [C25](#); for primary, secondary or fuel cells [H01M](#))
- H01G 9/025 . . . Solid electrolytes ([H01G 11/54](#) takes precedence )
- H01G 9/028 . . . . Organic semiconducting electrolytes, e.g. TCNQ

- H01G 9/032 . . . . Inorganic semiconducting electrolytes, e.g.  $\text{MnO}_2$
- H01G 9/035 . . . Liquid electrolytes, e.g. impregnating materials ([H01G 11/54](#) takes precedence)
- H01G 9/038 . . . Electrolytes specially adapted for double-layer capacitors

**WARNING**

This group is no longer used for classification of new documents as from October 1, 2012. The backfile is being continuously reclassified to group [H01G 11/54](#)

- H01G 9/04 . . Electrodes { or formation of dielectric layers thereon}
- H01G 2009/0404 . . . {characterised by the material (alloys in general see [C22C](#))}
- H01G 2009/0408 . . . . {on Al basis}
- H01G 2009/0412 . . . {characterised by the structure}
- H01G 2009/0416 . . . . {Etched foil electrodes (etching of metal in general [C23F](#); electro-etching of metal in general [C25F](#))}
- H01G 9/042 . . . characterised by the material ([H01G 11/22](#) takes precedence)
- H01G 9/0425 . . . . { specially adapted for cathode}
- H01G 9/045 . . . . based on aluminium
- H01G 9/048 . . . characterised by their structure ([H01G 11/22](#) takes precedence)
- H01G 2009/05 . . . . {IPC5 consisting of tantalum, niobium, or sintered material; Combinations of such electrodes with solid semiconductive electrolytes, e.g. manganese dioxide not used, see subgroups and [H01G9/00F](#), [H01G9/04B](#)}
- H01G 9/052 . . . . Sintered electrodes
- H01G 9/0525 . . . . . { Powder therefor (metallic powder in general [B22F](#))}
- H01G 9/055 . . . . Etched foil electrodes
- H01G 9/058 . . . specially adapted for double-layer capacitors

**WARNING**

This group is no longer used for classification of new documents as from October 1, 2012. The backfile is being continuously reclassified to group [H01G 11/22](#)

- H01G 9/06 . . . Mounting in containers

**WARNING**

This group is no longer used for classification of new documents as from October 1, 2012. The backfile is being continuously reclassified to groups [H01G 11/66](#) - [H01G 11/74](#)

- H01G 9/07 . . Dielectric layers
- H01G 9/08 . . Housing; Encapsulation
- H01G 9/10 . . . Sealing, e.g. of lead-in wires
- H01G 9/12 . . . Vents or other means allowing expansion

- H01G 9/14 . . Structural combinations { or circuits} for modifying, or compensating for, electric characteristics of electrolytic capacitors ([impedance networks H03H](#))
- H01G 9/145 . Liquid electrolytic capacitors ([H01G 11/00 takes precedence](#))
- H01G 9/15 . Solid electrolytic capacitors ([H01G 11/00 takes precedence](#))
- H01G 9/151 . . { with wound foil electrodes}
- H01G 9/153 . . { Skin fibre}
- H01G 9/155 . Double-layer capacitors

### **WARNING**

This group is no longer used for classification of new documents as from October 1, 2012. The backfile is being continuously reclassified to group [H01G 11/00](#) and its subgroups

- H01G 9/16 . specially for use as rectifiers or detectors ([H01G 9/22 takes precedence](#))
- H01G 9/18 . Self-interrupters
- H01G 9/20 . Light-sensitive devices
- H01G 9/2004 . . {characterised by the electrolyte, e.g. comprising an organic electrolyte}
- H01G 9/2009 . . . {Solid electrolytes}
- H01G 9/2013 . . . { the electrolyte comprising ionic liquids, e.g. alkyl imidazolium iodide}
- H01G 9/2018 . . . { characterised by the ionic charge transport species, e.g. redox shuttles}
- H01G 9/2022 . . {characterized by the counter electrode}
- H01G 9/2027 . . {comprising an oxide semiconductor electrode}
- H01G 9/2031 . . . { comprising titanium oxide, e.g. TiO<sub>2</sub> ([H01G 9/2036 takes precedence](#))}
- H01G 9/2036 . . . {comprising mixed oxides, e.g. ZnO covered TiO<sub>2</sub> particles}
- H01G 9/204 . . . { comprising zinc oxides, e.g. ZnO ([H01G 9/2036 takes precedence](#))}
- H01G 9/2045 . . {comprising a semiconductor electrode comprising elements of the fourth group of the Periodic System (C, Si, Ge, Sn, Pb) with or without impurities, e.g. doping materials}
- H01G 9/205 . . {comprising a semiconductor electrode comprising AIII-BV compounds with or without impurities, e.g. doping materials}
- H01G 9/2054 . . { comprising a semiconductor electrode comprising AII-BVI compounds, e.g. CdTe, CdSe, ZnTe, ZnSe, with or without impurities, e.g. doping materials ([H01G 9/2027 takes precedence](#))}
- H01G 9/2059 . . {comprising an organic dye as the active light absorbing material, e.g. adsorbed on an electrode or dissolved in solution}
- H01G 9/2063 . . . {comprising a mixture of two or more dyes}
- H01G 9/2068 . . {Panels or arrays of photoelectrochemical cells, e.g. photovoltaic modules based on photoelectrochemical cells}
- H01G 9/2072 . . . {comprising two or more photoelectrodes sensible to different parts of the solar spectrum, e.g. tandem cells}
- H01G 9/2077 . . . { Sealing arrangements, e.g. to prevent the leakage of the electrolyte}
- H01G 9/2081 . . . { Serial interconnection of cells}
- H01G 9/2086 . . . { Photoelectrochemical cells in the form of a fiber}

- H01G 9/209 . . { Light trapping arrangements}
- H01G 9/2095 . . {comprising a flexible substrate}
- H01G 9/21 . Temperature-sensitive devices
- H01G 9/22 . Devices using combined reduction and oxidation, e.g. redox arrangement or solion
- H01G 9/26 . Structural combinations of electrolytic capacitors, rectifiers, detectors, switching devices, light-sensitive or temperature-sensitive devices with each other
- H01G 9/28 . Structural combinations of electrolytic capacitors, rectifiers, detectors, switching devices with other electric components not covered by this subclass

**H01G 11/00 Hybrid capacitors, i.e. capacitors having different positive and negative electrodes; Electric double-layer [EDL] capacitors [EDLCs]; Processes specially adapted for the manufacture thereof or of parts thereof**

#### **NOTE**

Group [H01G 11/02](#) takes precedence over groups [H01G 11/04](#) - [H01G 11/14](#)

#### **WARNING**

Groups [H01G 11/00](#) to [H01G 11/86](#) correspond to IPC 2013.01. Concordance CPC - IPC 2012.01 for these groups is as follows: - [H01G 11/00](#) : [H01G 9/155](#) - [H01G 11/02](#) : [H01G 9/28](#); - [H01G 11/04](#) - [H01G 11/20](#): [H01G 9/155](#); - [H01G 11/22](#) - [H01G 11/50](#): [H01G 9/058](#); - [H01G 11/52](#) : [H01G 9/155](#); - [H01G 11/54](#) - [H01G 11/64](#) : [H01G 9/038](#); - [H01G 11/66](#) - [H01G 11/76](#) : [H01G 9/016](#); - [H01G 11/78](#) - [H01G 11/84](#) : [H01G 9/155](#); - [H01G 11/86](#) : [H01G 9/058](#)

- H01G 11/02 . using combined reduction-oxidation reactions, e.g. redox arrangement or solion
- H01G 11/04 . Hybrid capacitors
- H01G 11/06 . . with one of the electrodes allowing ions or anions to be reversibly doped thereinto, e.g. lithium-ion capacitors [LICs]
- H01G 11/08 . Structural combinations, e.g. assembly or connection, of hybrid or EDL capacitors with other electric components, at least one hybrid or EDL capacitor being the main component
- H01G 11/10 . Multiple hybrid or EDL capacitors, e.g. arrays or modules ( [housings, cases or mountings thereof H01G 11/78](#))
- H01G 11/12 . . Stacked hybrid or EDL capacitors
- H01G 11/14 . Arrangements or processes for adjusting or protecting hybrid or EDL capacitors ([emergency protective circuit arrangements specially adapted for capacitors, and effecting automatic switching in the event of an undesired change from normal working conditions H02H 7/16](#); [emergency protective circuit arrangements for limiting excess current or voltages without disconnection H02H 9/00](#))
- H01G 11/16 . . against electric overloads, e.g. including fuses
- H01G 11/18 . . against thermal overloads, e.g. heating, cooling or ventilating
- H01G 11/20 . . Reformation or processes for removal of impurities, e.g. scavenging
- H01G 11/22 . Electrodes
- H01G 11/24 . . characterised by structural features, e.g. forms, shapes, surface areas, porosities or dimensions, of the materials making up or comprised in the electrodes; characterised by the structural features of powders or particles used therefor

- H01G 11/26 .. characterised by the structures of the electrodes, e.g. multi-layered, shapes, dimensions, porosities or surface features
- H01G 11/28 ... arranged or disposed on a current collector; Layers or phases between electrodes and current collectors, e.g. adhesives
- H01G 11/30 .. characterised by their materials
- H01G 11/32 ... Carbon-based, e.g. activated carbon materials
- H01G 11/34 .... characterised by carbonisation or activation of carbon
- H01G 11/36 .... Nanostructures, e.g. nanofibres, nanotubes or fullerenes
- H01G 11/38 .... Carbon pastes or blends; Binders or additives therein
- H01G 11/40 .... Fibres
- H01G 11/42 .... Powders or particles, e.g. composition thereof
- H01G 11/44 .... Raw materials therefor, e.g. resins or coal
- H01G 11/46 ... Metal oxides, e.g. ruthenium oxide
- H01G 11/48 ... Conductive polymers
- H01G 11/50 ... specially adapted for lithium-ion capacitors, e.g. for lithium-doping or for intercalation
- H01G 11/52 . Separators
- H01G 11/54 . Electrolytes
- H01G 11/56 .. Solid electrolytes, e.g. gel; Additives therein
- H01G 11/58 .. Liquid electrolytes
- H01G 11/60 ... characterised by the solvent
- H01G 11/62 ... characterised by the solute, e.g. salts, anions or cations therein
- H01G 11/64 ... characterised by additives
- H01G 11/66 . Current collectors
- H01G 11/68 .. characterised by their materials
- H01G 11/70 .. characterised by their structures
- H01G 11/72 .. specially adapted for integration in multiple or stacked hybrid or EDL capacitors
- H01G 11/74 . Terminals, e.g. extensions of current collectors
- H01G 11/76 .. specially adapted for integration in multiple or stacked hybrid or EDL capacitors
- H01G 11/78 . Cases; Housings; Encapsulations; Mountings
- H01G 11/80 .. Gaskets; Sealings
- H01G 11/82 .. Fixing or assembling a capacitive element in a housing, e.g. mounting electrodes, current collectors or terminals in containers or encapsulations
- H01G 11/84 . Processes for the manufacture of hybrid or EDL capacitors, or components thereof
- H01G 11/86 .. specially adapted for electrodes ([carbonization or activation of carbon for the manufacture of electrodes H01G 11/34](#))
- H01G 13/00** **Apparatus specially adapted for manufacturing capacitors; Processes specially adapted for manufacturing capacitors not provided for in groups [H01G 4/00](#) to [H01G 11/00](#)**
- H01G 13/003 . {Apparatus or processes for encapsulating capacitors}
- H01G 13/006 . {Apparatus or processes for applying terminals}



- H01G 13/02 . Machines for winding capacitors ([winding in general B65H](#))
- H01G 13/04 . Drying ([in general F26B](#)); Impregnating
- H01G 13/06 . with provision of removing metal surfaces
  
- H01G 15/00** **Structural combinations of capacitors or other devices covered by at least two different main groups of this subclass with each other** ([involving at least one hybrid or electric double-layer \[EDL\] capacitor as main component H01G 11/08](#))
  
- H01G 17/00** **Structural combinations of capacitors or other devices covered by at least two different main groups of this subclass with other electric elements, not covered by this subclass, e.g. RC combinations** ([thin- or thick-film circuits H01L 27/00](#); [RC-filters H03H](#))