

**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 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 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. MnO<sub>2</sub>
- 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 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 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 [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](#) - [11/20](#): [H01G 9/155](#);- [H01G 11/22](#) - [11/50](#): [H01G 9/058](#);- [H01G 11/52](#) : [H01G 9/155](#);- [H01G 11/54](#) - [11/64](#) : [H01G 9/038](#);- [H01G 11/66](#) - [11/76](#) : [H01G 9/016](#);- [H01G 11/78](#) - [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](#))**
  
  
- [H01G 2004/00](#)** **Fixed capacitors; Processes of their manufacture (electrolytic capacitors [H01G 9/00](#))**
- [H01G 2004/06](#) . Solid dielectrics
- [H01G 2004/24](#) . . [D0608]
  
- [H01G 2005/00](#)** **Capacitors in which the capacitance is varied by mechanical means, e.g. by turning a shaft; Processes of their manufacture**
- [H01G 2005/02](#) . IPC5 having air, gas, or vacuum as the dielectric
  
- [H01G 2009/00](#)** **Electrolytic capacitors, rectifiers, detectors, switching devices, light-sensitive or temperature-sensitive devices; Processes of their manufacture**
- [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 2009/04 . 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 2009/048 .. 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 [H01G 9/00F](#), [H01G 9/04B](#)
- H01G 2009/0503 ... characterised by the material
- H01G 2009/0506 .... specially adapted for cathode
- H01G 2009/0509 ... characterised by the structure
- H01G 2009/0513 .... sintered
- H01G 2009/0516 ..... Powder therefor ([metallic powder in general B22F](#))