

1.

H01L 21/00**Processes or apparatus adapted for the manufacture or treatment of semiconductor or solid state devices or of parts thereof****NOTE**

{Due to the ongoing developments in class H10 and related subclasses, the information displayed in notes, references and definitions of this main group and indents may not be entirely accurate. For each specific subject matter referred to in this main group and indents, users are invited to consult the relevant place in class H10 and to consider the class H10 information as correct, in case of conflict}

H01L 21/02

. Manufacture or treatment of semiconductor devices or of parts thereof

H01L 21/02002

. . {Preparing wafers}

NOTES

1. {This group covers processes for manufacturing wafers prior to the fabrication of any device, i.e. between the sawing of ingots (covered by B28D) and the cleaning of substrates (covered by H01L 21/02041). }
2. {This group does not cover:
 - simple use of grinding or polishing machines B24B
 - thermal smoothening H01L 21/324.

H01L 21/02005

. . . {Preparing bulk and homogeneous wafers}

H01L 21/02008

. . . . {Multistep processes}

H01L 21/0201

. {Specific process step}

H01L 21/02013

. {Grinding, lapping}

H01L 21/02016

. {Backside treatment}

H01L 21/02019

. {Chemical etching}

H01L 21/02021

. {Edge treatment, chamfering}

H01L 21/02024

. {Mirror polishing}

H01L 21/02027

. . . . {Setting crystal orientation}

H01L 21/0203

. . . . {Making porous regions on the surface}

H01L 21/02032

. . . . {by reclaiming or re-processing}

H01L 21/02035

. . . . {Shaping}

H01L 21/02041

. . {Cleaning}

H01L 21/02043

. . . {Cleaning before device manufacture, i.e. Begin-Of-Line process}

H01L 21/02046

. . . . {Dry cleaning only (H01L 21/02085 takes precedence)}

H01L 21/02049

. {with gaseous HF}

H01L 21/02052

. . . . {Wet cleaning only (H01L 21/02085 takes precedence)}

H01L 21/02054

. . . . {combining dry and wet cleaning steps (H01L 21/02085 takes precedence)}

H01L 21/02057

. . . {Cleaning during device manufacture}

H01L 21/0206

. . . . {during, before or after processing of insulating layers}

H01L 21/02063

. {the processing being the formation of vias or contact holes}

H01L 21/02065

. {the processing being a planarization of insulating layers}

H01L 21/02068

. . . . {during, before or after processing of conductive layers, e.g. polysilicon or amorphous silicon layers}

H01L 21/02071

. {the processing being a delineation, e.g. RIE, of conductive layers}

H01L 21/02074

. {the processing being a planarization of conductive layers}

H01L 21/02076

. . . {Cleaning after the substrates have been singulated}

H01L 21/02079

. . . {Cleaning for reclaiming}

H01L 21/02082

. . . {product to be cleaned}

H01L 21/02085	 {Cleaning of diamond}
H01L 21/02087	 {Cleaning of wafer edges}
H01L 21/0209	 {Cleaning of wafer backside}
H01L 21/02093	 {Cleaning of porous materials}
H01L 21/02096	. . . {only mechanical cleaning}
H01L 21/02098	. . . {only involving lasers, e.g. laser ablation}
H01L 21/02101	. . . {only involving supercritical fluids}
H01L 21/02104	. . {Forming layers (deposition in general C23C; crystal growth in general C30B)}
H01L 21/02107	. . . {Forming insulating materials on a substrate}
H01L 21/02109	 {characterised by the type of layer, e.g. type of material, porous/non-porous, pre-cursors, mixtures or laminates}
H01L 21/02112	 {characterised by the material of the layer}

NOTE

{Layers comprising sublayers, i.e. multi-layers, are additionally classified in H01L 21/022; porous layers are additionally classified in H01L 21/02203.}

H01L 21/02115	 {the material being carbon, e.g. alpha-C, diamond or hydrogen doped carbon}
H01L 21/02118	 {carbon based polymeric organic or inorganic material, e.g. polyimides, poly cyclobutene or PVC (polymers per se C08G, photoresist per se G03F)}
H01L 21/0212	 {the material being fluoro carbon compounds, e.g. (CFx) n, (CHxFy) n or polytetrafluoroethylene}
H01L 21/02123	 {the material containing silicon}
H01L 21/02126	 {the material containing Si, O, and at least one of H, N, C, F, or other non-metal elements, e.g. SiOC, SiOC:H or SiONC}
H01L 21/02129	 {the material being boron or phosphorus doped silicon oxides, e.g. BPSG, BSG or PSG}

NOTE

{Halogen, e.g. fluorine, containing BPSG, PSG, BSG, and the like, are additionally classified in H01L 21/02131.}

H01L 21/02131	 {the material being halogen doped silicon oxides, e.g. FSG}
H01L 21/02134	 {the material comprising hydrogen silsesquioxane, e.g. HSQ}
H01L 21/02137	 {the material comprising alkyl silsesquioxane, e.g. MSQ}
H01L 21/0214	 {the material being a silicon oxynitride, e.g. SiON or SiON:H}
H01L 21/02142	 {the material containing silicon and at least one metal element, e.g. metal silicate based insulators or metal silicon oxynitrides}
H01L 21/02145	 {the material containing aluminium, e.g. AlSiOx}
H01L 21/02148	 {the material containing hafnium, e.g. HfSiOx or HfSiON}
H01L 21/0215	 {the material containing tantalum, e.g. TaSiOx}
H01L 21/02153	 {the material containing titanium, e.g. TiSiOx}
H01L 21/02156	 {the material containing at least one rare earth element, e.g. silicate of lanthanides, scandium or yttrium}
H01L 21/02159	 {the material containing zirconium, e.g. ZrSiOx}
H01L 21/02161	 {the material containing more than one metal element}

H01L 21/02164 {the material being a silicon oxide, e.g. SiO₂}

NOTE

{ The formation of silicon oxide layers is classified in this group regardless of the precursor or of the process of formation; in case of explicit statements on doping, on rest-groups, or on material components see H01L 21/02126 and subgroups; deposition of silicon oxide from organic precursors without further statements on film composition is classified here and in H01L 21/02205 and subgroups. }

H01L 21/02167 {the material being a silicon carbide not containing oxygen, e.g. SiC, SiC:H or silicon carbonitrides (H01L 21/02126 and H01L 21/0214 take precedence)}

H01L 21/0217 {the material being a silicon nitride not containing oxygen, e.g. Si₃N₄ or Si₃ByN_z (H01L 21/02126 and H01L 21/0214 take precedence)}

H01L 21/02172 {the material containing at least one metal element, e.g. metal oxides, metal nitrides, metal oxynitrides or metal carbides (materials containing silicon H01L 21/02123; metal silicates H01L 21/02142)}

H01L 21/02175 {characterised by the metal (H01L 21/02197 takes precedence)}

H01L 21/02178 {the material containing aluminium, e.g. Al₂O₃}

H01L 21/02181 {the material containing hafnium, e.g. HfO₂}

H01L 21/02183 {the material containing tantalum, e.g. Ta₂O₅}

H01L 21/02186 {the material containing titanium, e.g. TiO₂}

H01L 21/02189 {the material containing zirconium, e.g. ZrO₂}

H01L 21/02192 {the material containing at least one rare earth metal element, e.g. oxides of lanthanides, scandium or yttrium}

H01L 21/02194 {the material containing more than one metal element}

H01L 21/02197 {the material having a perovskite structure, e.g. BaTiO₃}

H01L 21/022 {the layer being a laminate, i.e. composed of sublayers, e.g. stacks of alternating high-k metal oxides (adhesion layers or buffer layers H01L 21/02304, H01L 21/02362)}

H01L 21/02203 {the layer being porous}

H01L 21/02205 {the layer being characterised by the precursor material for deposition}

H01L 21/02208 {the precursor containing a compound comprising Si}

H01L 21/02211 {the compound being a silane, e.g. disilane, methylsilane or chlorosilane}

H01L 21/02214 {the compound comprising silicon and oxygen}

NOTE

{This group does not cover mixtures of a silane and oxygen.}

H01L 21/02216 {the compound being a molecule comprising at least one silicon-oxygen bond and the compound having hydrogen or an organic group attached to the silicon or oxygen, e.g. a siloxane}

H01L 21/02219 {the compound comprising silicon and nitrogen}

NOTE

{This group does not cover mixtures of silane and nitrogen.}

H01L 21/02222 {the compound being a silazane}

H01L 21/02225 {characterised by the process for the formation of the insulating layer}

H01L 21/02227 {formation by a process other than a deposition process}

NOTE

{Subject matter classified in the range of H01L 21/0223 - H01L 21/02249 is additionally classified in H01L 21/02249, H01L 21/02255 and H01L 21/02252, depending on the type of reaction. }

H01L 21/0223 {formation by oxidation, e.g. oxidation of the substrate}
H01L 21/02233 {of the semiconductor substrate or a semiconductor layer}
H01L 21/02236 {group IV semiconductor}
H01L 21/02238 {silicon in uncombined form, i.e. pure silicon}
H01L 21/02241 {III-V semiconductor}
H01L 21/02244 {of a metallic layer}
H01L 21/02247 {formation by nitridation, e.g. nitridation of the substrate}
H01L 21/02249 {formation by combined oxidation and nitridation performed simultaneously}
H01L 21/02252 {formation by plasma treatment, e.g. plasma oxidation of the substrate (after treatment of an insulating film by plasma H01L 21/3105 and subgroups)}
H01L 21/02255 {formation by thermal treatment (H01L 21/02252 takes precedence; after treatment of an insulating film H01L 21/3105 and subgroups)}
H01L 21/02258 {formation by anodic treatment, e.g. anodic oxidation}
H01L 21/0226 {formation by a deposition process (per se C23C)}
H01L 21/02263 {deposition from the gas or vapour phase}

NOTE

{This group and subgroups also cover deposition methods in which the gas or vapour is produced by physical means, e.g. ablation from targets or heating of source material.}

H01L 21/02266 {deposition by physical ablation of a target, e.g. sputtering, reactive sputtering, physical vapour deposition or pulsed laser deposition}
H01L 21/02269 {deposition by thermal evaporation (H01L 21/02293 takes precedence)}

NOTE

{Subject matter relating to molecular beam epitaxy is classified in this group.}

H01L 21/02271 {deposition by decomposition or reaction of gaseous or vapour phase compounds, i.e. chemical vapour deposition (H01L 21/02266 takes precedence)}
H01L 21/02274 {in the presence of a plasma [PECVD]}
H01L 21/02277 {the reactions being activated by other means than plasma or thermal, e.g. photo-CVD}
H01L 21/0228 {deposition by cyclic CVD, e.g. ALD, ALE, pulsed CVD}

NOTE

{Subject matter relating to cyclic plasma CVD is additionally classified in H01L 21/02274.}

H01L 21/02282 {liquid deposition, e.g. spin-coating, sol-gel techniques, spray coating}
H01L 21/02285 {Langmuir-Blodgett techniques}
H01L 21/02288 {printing, e.g. ink-jet printing (per se B41J)}
H01L 21/0229 {liquid atomic layer deposition}

H01L 21/02293 {formation of epitaxial layers by a deposition process (epitaxial growth per se C30B)}

NOTE

{Formation of non-epitaxial layers by MBE, ALE, etc. is not covered by this group; for MBE see H01L 21/02269; for ALE see H01L 21/0228.}

H01L 21/02296 {characterised by the treatment performed before or after the formation of the layer (H01L 21/02227 and subgroups take precedence)}

NOTE

{This group and subgroups only cover processes which are directly linked to the layer formation; routine anneals, i.e. thermal treatment without further features like a special atmosphere, presence of a plasma, thermally induced chemical reactions, change of phase (crystal structure) etc. are not classified here; for cleaning see H01L 21/02041 and subgroups; for etching processes see H01L 21/311 and subgroups; for planarization processes see H01L 21/31051 and subgroups; for processes to repair etch damage see H01L 21/3105 and subgroups. }

H01L 21/02299 {pre-treatment}

NOTE

{This group and subgroups cover treatments to improve adhesion or change the surface termination; for etching see H01L 21/306 and subgroups and H01L 21/311 and subgroups. }

H01L 21/02301 {in-situ cleaning}

NOTE

{Subject matter relating to the cleaning processes for semiconductor devices in general is covered by H01L 21/02041 and subgroups.}

H01L 21/02304 {formation of intermediate layers, e.g. buffer layers, layers to improve adhesion, lattice match or diffusion barriers}

H01L 21/02307 {treatment by exposure to a liquid}

H01L 21/0231 {treatment by exposure to electromagnetic radiation, e.g. UV light}

H01L 21/02312 {treatment by exposure to a gas or vapour}

H01L 21/02315 {treatment by exposure to a plasma}

H01L 21/02318 {post-treatment}

NOTE

{This group only covers processes that are part of the layer formation; treatments which are performed after completion of the insulating layer are covered by H01L 21/3105 and subgroups. }

H01L 21/02321 {introduction of substances into an already existing insulating layer (H01L 21/02227 and subgroups take precedence)}

NOTE

{Processes like the introduction of phosphorus into silicon oxide by diffusion, or doping of an already existing insulating layer are covered by this group and subgroups; for the method of introduction, see H01L 21/02337, H01L 21/02343, H01L 21/02345 and subgroups.}

H01L 21/02323 {introduction of oxygen}

H01L 21/02326 {into a nitride layer, e.g. changing SiN to SiON}
H01L 21/02329 {introduction of nitrogen}
H01L 21/02332 {into an oxide layer, e.g. changing SiO to SiON}
H01L 21/02334 {in-situ cleaning after layer formation, e.g. removing process residues}

NOTE

{Subject matter relating to the cleaning processes for semiconductor devices in general is covered by H01L 21/02041 and subgroups. }

H01L 21/02337 {treatment by exposure to a gas or vapour}
H01L 21/0234 {treatment by exposure to a plasma}
H01L 21/02343 {treatment by exposure to a liquid}
H01L 21/02345 {treatment by exposure to radiation, e.g. visible light}
H01L 21/02348 {treatment by exposure to UV light}
H01L 21/02351 {treatment by exposure to corpuscular radiation, e.g. exposure to electrons, alpha-particles, protons or ions}
H01L 21/02354 {using a coherent radiation, e.g. a laser}
H01L 21/02356 {treatment to change the morphology of the insulating layer, e.g. transformation of an amorphous layer into a crystalline layer}
H01L 21/02359 {treatment to change the surface groups of the insulating layer}
H01L 21/02362 {formation of intermediate layers, e.g. capping layers or diffusion barriers}
H01L 21/02365 . . . {Forming inorganic semiconducting materials on a substrate}
H01L 21/02367 {Substrates}
H01L 21/0237 {Materials}
H01L 21/02373 {Group 14 semiconducting materials}
H01L 21/02376 {Carbon, e.g. diamond-like carbon}
H01L 21/02378 {Silicon carbide}
H01L 21/02381 {Silicon, silicon germanium, germanium}
H01L 21/02384 {including tin}
H01L 21/02387 {Group 13/15 materials}
H01L 21/02389 {Nitrides}
H01L 21/02392 {Phosphides}
H01L 21/02395 {Arsenides}
H01L 21/02398 {Antimonides}
H01L 21/024 {Group 12/16 materials}
H01L 21/02403 {Oxides}
H01L 21/02406 {Sulfides}
H01L 21/02409 {Selenides}
H01L 21/02411 {Tellurides}
H01L 21/02414 {Oxide semiconducting materials not being Group 12/16 materials, e.g. ternary compounds}
H01L 21/02417 {Chalcogenide semiconducting materials not being oxides, e.g. ternary compounds}
H01L 21/0242 {Crystalline insulating materials}
H01L 21/02422 {Non-crystalline insulating materials, e.g. glass, polymers}
H01L 21/02425 {Conductive materials, e.g. metallic silicides}
H01L 21/02428 {Structure}
H01L 21/0243 {Surface structure}
H01L 21/02433 {Crystal orientation}
H01L 21/02436 {Intermediate layers between substrates and deposited layers}
H01L 21/02439 {Materials}
H01L 21/02441 {Group 14 semiconducting materials}
H01L 21/02444 {Carbon, e.g. diamond-like carbon}

H01L 21/02447	 {Silicon carbide}
H01L 21/0245	 {Silicon, silicon germanium, germanium}
H01L 21/02452	 {including tin}
H01L 21/02455	 {Group 13/15 materials}
H01L 21/02458	 {Nitrides}
H01L 21/02461	 {Phosphides}
H01L 21/02463	 {Arsenides}
H01L 21/02466	 {Antimonides}
H01L 21/02469	 {Group 12/16 materials}
H01L 21/02472	 {Oxides}
H01L 21/02474	 {Sulfides}
H01L 21/02477	 {Selenides}
H01L 21/0248	 {Tellurides}
H01L 21/02483	 {Oxide semiconducting materials not being Group 12/16 materials, e.g. ternary compounds}
H01L 21/02485	 {Other chalcogenide semiconducting materials not being oxides, e.g. ternary compounds}
H01L 21/02488	 {Insulating materials}
H01L 21/02491	 {Conductive materials}
H01L 21/02494	 {Structure}
H01L 21/02496	 {Layer structure}
H01L 21/02499	 {Monolayers}
H01L 21/02502	 {consisting of two layers}
H01L 21/02505	 {consisting of more than two layers}
H01L 21/02507	 {Alternating layers, e.g. superlattice}
H01L 21/0251	 {Graded layers}
H01L 21/02513	 {Microstructure}
H01L 21/02516	 {Crystal orientation}
H01L 21/02518	 {Deposited layers}
H01L 21/02521	 {Materials}
H01L 21/02524	 {Group 14 semiconducting materials}
H01L 21/02527	 {Carbon, e.g. diamond-like carbon}
H01L 21/02529	 {Silicon carbide}
H01L 21/02532	 {Silicon, silicon germanium, germanium}
H01L 21/02535	 {including tin}
H01L 21/02538	 {Group 13/15 materials}
H01L 21/0254	 {Nitrides}
H01L 21/02543	 {Phosphides}
H01L 21/02546	 {Arsenides}
H01L 21/02549	 {Antimonides}
H01L 21/02551	 {Group 12/16 materials}
H01L 21/02554	 {Oxides}
H01L 21/02557	 {Sulfides}
H01L 21/0256	 {Selenides}
H01L 21/02562	 {Tellurides}
H01L 21/02565	 {Oxide semiconducting materials not being Group 12/16 materials, e.g. ternary compounds}
H01L 21/02568	 {Chalcogenide semiconducting materials not being oxides, e.g. ternary compounds}
H01L 21/0257	 {Doping during depositing}
H01L 21/02573	 {Conductivity type}
H01L 21/02576	 {N-type}
H01L 21/02579	 {P-type}
H01L 21/02581	 {Transition metal or rare earth elements}

H01L 21/02584	 {Delta-doping}
H01L 21/02587	 {Structure}
H01L 21/0259	 {Microstructure}
H01L 21/02592	 {amorphous}
H01L 21/02595	 {polycrystalline}
H01L 21/02598	 {monocrystalline}
H01L 21/02601	 {Nanoparticles (fullerenes H10K 85/211)}
H01L 21/02603	 {Nanowires}
H01L 21/02606	 {Nanotubes (carbon nanotubes H10K 85/211)}
H01L 21/02609	 {Crystal orientation}
H01L 21/02612	 {Formation types}
H01L 21/02614	 {Transformation of metal, e.g. oxidation, nitridation}
H01L 21/02617	 {Deposition types}
H01L 21/0262	 {Reduction or decomposition of gaseous compounds, e.g. CVD}
H01L 21/02623	 {Liquid deposition}
H01L 21/02625	 {using melted materials}
H01L 21/02628	 {using solutions}
H01L 21/02631	 {Physical deposition at reduced pressure, e.g. MBE, sputtering, evaporation}
H01L 21/02634	 {Homoepitaxy}
H01L 21/02636	 {Selective deposition, e.g. simultaneous growth of mono- and non-monocrystalline semiconductor materials}
H01L 21/02639	 {Preparation of substrate for selective deposition}
H01L 21/02642	 {Mask materials other than SiO ₂ or SiN}
H01L 21/02645	 {Seed materials}
H01L 21/02647	 {Lateral overgrowth}
H01L 21/0265	 {Pendeoepitaxy}
H01L 21/02653	 {Vapour-liquid-solid growth}
H01L 21/02656	 {Special treatments}
H01L 21/02658	 {Pretreatments (cleaning in general H01L 21/02041)}
H01L 21/02661	 {In-situ cleaning}
H01L 21/02664	 {Aftertreatments (planarisation in general H01L 21/304)}
H01L 21/02667	 {Crystallisation or recrystallisation of non-monocrystalline semiconductor materials, e.g. regrowth}
H01L 21/02669	 {using crystallisation inhibiting elements}
H01L 21/02672	 {using crystallisation enhancing elements}
H01L 21/02675	 {using laser beams}
H01L 21/02678	 {Beam shaping, e.g. using a mask}
H01L 21/0268	 {Shape of mask}
H01L 21/02683	 {Continuous wave laser beam}
H01L 21/02686	 {Pulsed laser beam}
H01L 21/02689	 {using particle beams}
H01L 21/02691	 {Scanning of a beam}
H01L 21/02694	 {Controlling the interface between substrate and epitaxial layer, e.g. by ion implantation followed by annealing}
H01L 21/02697	. . . {Forming conducting materials on a substrate}
H01L 21/027	. . Making masks on semiconductor bodies for further photolithographic processing not provided for in group H01L 21/18 or H01L 21/34 {(photographic masks or originals <u>per se</u> G03F 1/00 ; registration or positioning of photographic masks or originals G03F 9/00 ; photographic cameras G03B ; control of position G05D 3/00)}
H01L 21/0271	. . . {comprising organic layers}
H01L 21/0272	. . . {for lift-off processes}
H01L 21/0273	. . . {characterised by the treatment of photoresist layers}

H01L 21/0274	 {Photolithographic processes}
H01L 21/0275	 {using lasers}
H01L 21/0276	 {using an anti-reflective coating (anti-reflective coating for lithography in general G03F 7/09)}
H01L 21/0277	 {Electrolithographic processes}
H01L 21/0278	 {Röntgenlithographic or X-ray lithographic processes}
H01L 21/0279	 {Ionlithographic processes}
H01L 21/033	. . . comprising inorganic layers
H01L 21/0331	 {for lift-off processes}
H01L 21/0332	 {characterised by their composition, e.g. multilayer masks, materials}
H01L 21/0334	 {characterised by their size, orientation, disposition, behaviour, shape, in horizontal or vertical plane}
H01L 21/0335	 {characterised by their behaviour during the process, e.g. soluble masks, redeposited masks}
H01L 21/0337	 {characterised by the process involved to create the mask, e.g. lift-off masks, sidewalls, or to modify the mask, e.g. pre-treatment, post-treatment}
H01L 21/0338	 {Process specially adapted to improve the resolution of the mask}
H01L 21/04	. . the devices having potential barriers, e.g. a PN junction, depletion layer or carrier concentration layer
H01L 21/0405	. . . {the devices having semiconductor bodies comprising semiconducting carbon, e.g. diamond, diamond-like carbon}

NOTE

{This group covers passivation.}

H01L 21/041	 {Making n- or p-doped regions}
H01L 21/0415	 {using ion implantation}
H01L 21/042	 {Changing their shape, e.g. forming recesses (etching of the semiconductor body H01L 21/302)}
H01L 21/0425	 {Making electrodes}
H01L 21/043	 {Ohmic electrodes}
H01L 21/0435	 {Schottky electrodes}
H01L 21/044	 {Conductor-insulator-semiconductor electrodes}
H01L 21/0445	. . . {the devices having semiconductor bodies comprising crystalline silicon carbide}
H01L 21/045	 {passivating silicon carbide surfaces}
H01L 21/0455	 {Making n or p doped regions or layers, e.g. using diffusion}
H01L 21/046	 {using ion implantation}

NOTE

{Processes where ion implantation of boron and subsequent annealing does not produce a p-doped region are classified elsewhere, e.g. H01L 21/0445.}

H01L 21/0465	 {using masks}
H01L 21/047	 {characterised by the angle between the ion beam and the crystal planes or the main crystal surface}
H01L 21/0475	 {Changing the shape of the semiconductor body, e.g. forming recesses, (etching of the semiconductor body H01L 21/302)}
H01L 21/048	 {Making electrodes}
H01L 21/0485	 {Ohmic electrodes}
H01L 21/049	 {Conductor-insulator-semiconductor electrodes, e.g. MIS contacts}
H01L 21/0495	 {Schottky electrodes}

H01L 21/18

- . . . the devices having semiconductor bodies comprising elements of Group IV of the Periodic Table or $A_{III}B_V$ compounds with or without impurities, e.g. doping materials {(H01L 21/041 - H01L 21/0425, H01L 21/045 - H01L 21/048 take precedence)}

NOTE

This group covers also processes and apparatus which, by using the appropriate technology, are clearly suitable for manufacture or treatment of devices whose bodies comprise elements of Group IV of the Periodic Table or $A_{III}B_V$ compounds, even if the material used is not explicitly specified.

H01L 21/182

- . . . {Intermixing or interdiffusion or disordering of III-V heterostructures, e.g. IILD}

H01L 21/185

- . . . {Joining of semiconductor bodies for junction formation}

H01L 21/187

- . . . {by direct bonding}

H01L 21/20

- . . . Deposition of semiconductor materials on a substrate, e.g. epitaxial growth {solid phase epitaxy}

H01L 21/2003

- . . . {characterised by the substrate}

H01L 21/2007

- . . . {Bonding of semiconductor wafers to insulating substrates or to semiconducting substrates using an intermediate insulating layer (H01L 21/2011 takes precedence; bonding of semiconductor wafers to semiconductor wafers for junction formation H01L 21/187)}

H01L 21/2011

- . . . {the substrate being of crystalline insulating material, e.g. sapphire}

H01L 21/2015

- . . . {the substrate being of crystalline semiconductor material, e.g. lattice adaptation, heteroepitaxy}

H01L 21/22

- . . . Diffusion of impurity materials, e.g. doping materials, electrode materials, into or out of a semiconductor body, or between semiconductor regions; {Interactions between two or more impurities; Redistribution of impurities}

H01L 21/2205

- . . . {from the substrate during epitaxy, e.g. autodoping; Preventing or using autodoping}

H01L 21/221

- . . . {of killers}

H01L 21/2215

- . . . {in $A_{III}B_V$ compounds}

H01L 21/222

- . . . {Lithium-drift}

H01L 21/2225

- . . . {Diffusion sources}

H01L 21/223

- . . . using diffusion into or out of a solid from or into a gaseous phase {(H01L 21/221 - H01L 21/222 take precedence; diffusion through an applied layer H01L 21/225)}

H01L 21/2233

- . . . {Diffusion into or out of $A_{III}B_V$ compounds}

H01L 21/2236

- . . . {from or into a plasma phase}

H01L 21/225

- . . . using diffusion into or out of a solid from or into a solid phase, e.g. a doped oxide layer {(H01L 21/221 - H01L 21/222 take precedence)}

H01L 21/2251

- . . . {Diffusion into or out of group IV semiconductors}

NOTE

{In groups H01L 21/2254 - H01L 21/2257 one should consider the main compositional parts of the applied layer just before the diffusion step}

H01L 21/2252

- . . . {using predeposition of impurities into the semiconductor surface, e.g. from a gaseous phase}

H01L 21/2253

- . . . {by ion implantation}

H01L 21/2254

- . . . {from or through or into an applied layer, e.g. photoresist, nitrides}

H01L 21/2255

- . . . {the applied layer comprising oxides only, e.g. P_2O_5 , PSG, H_3BO_3 , doped oxides}

H01L 21/2256

- . . . {through the applied layer}

H01L 21/2257

- . . . {the applied layer being silicon or silicide or SIPOS, e.g. polysilicon, porous silicon}

H01L 21/2258

- . . . {Diffusion into or out of $A_{III}B_V$ compounds}

H01L 21/228	 using diffusion into or out of a solid from or into a liquid phase, e.g. alloy diffusion processes {(H01L 21/221 - H01L 21/222 take precedence)}
H01L 21/24	 Alloying of impurity materials, e.g. doping materials, electrode materials, with a semiconductor body {(H01L 21/182 takes precedence)}
H01L 21/242	 {Alloying of doping materials with A _{III} B _V compounds}
H01L 21/244	 {Alloying of electrode materials}
H01L 21/246	 {with A _{III} B _V compounds}
H01L 21/248	 {Apparatus specially adapted for the alloying}
H01L 21/26	 Bombardment with radiation {(H01L 21/3105 takes precedence)}
H01L 21/2605	 {using natural radiation, e.g. alpha, beta or gamma radiation}
H01L 21/261	 to produce a nuclear reaction transmuting chemical elements
H01L 21/263	 with high-energy radiation (H01L 21/261 takes precedence)
H01L 21/2633	 {for etching, e.g. sputteretching}
H01L 21/2636	 {for heating, e.g. electron beam heating}
H01L 21/265	 producing ion implantation
H01L 21/26506	 {in group IV semiconductors}
H01L 21/26513	 {of electrically active species}
H01L 21/2652	 {Through-implantation}
H01L 21/26526	 {Recoil-implantation}
H01L 21/26533	 {of electrically inactive species in silicon to make buried insulating layers}
H01L 21/2654	 {in A _{III} B _V compounds}
H01L 21/26546	 {of electrically active species}
H01L 21/26553	 {Through-implantation}
H01L 21/2656	 {characterised by the implantation of both electrically active and inactive species in the same semiconductor region to be doped}
H01L 21/26566	 {of a cluster, e.g. using a gas cluster ion beam}
H01L 2021/26573	 {in diamond}
H01L 21/2658	 {of a molecular ion, e.g. decaborane}
H01L 21/26586	 {characterised by the angle between the ion beam and the crystal planes or the main crystal surface}
H01L 21/26593	 {at a temperature lower than room temperature}
H01L 21/266	 using masks {(H01L 21/26586 takes precedence)}
H01L 21/268	 using electromagnetic radiation, e.g. laser radiation
H01L 21/2683	 {using X-ray lasers}
H01L 21/2686	 {using incoherent radiation}
H01L 21/28	 Manufacture of electrodes on semiconductor bodies using processes or apparatus not provided for in groups H01L 21/20 - H01L 21/268
H01L 21/28008	 {Making conductor-insulator-semiconductor electrodes}
H01L 21/28017	 {the insulator being formed after the semiconductor body, the semiconductor being silicon}

NOTE

{This group covers deposition of the insulators, including epitaxial insulators, and the conductors within the same process or chamber.}

H01L 21/28026	 {characterised by the conductor (H01L 21/28176 takes precedence)}
---------------	---

NOTE

{When the final conductor comprises a superconductor, subject matter is not classified according to the subgroups H01L 21/28035 - H01L 21/28097. Instead, it is classified in H01L 21/28026.}

H01L 21/28035 {the final conductor layer next to the insulator being silicon, e.g. polysilicon, with or without impurities (H01L 21/28105 takes precedence)}

NOTE

{A very thin, e.g. silicon, adhesion or seed layer is not considered as the one next to the insulator.}

H01L 21/28044 {the conductor comprising at least another non-silicon conductive layer}

H01L 21/28052 {the conductor comprising a silicide layer formed by the silicidation reaction of silicon with a metal layer (formed by metal ion implantation H01L 21/28044)}

H01L 21/28061 {the conductor comprising a metal or metal silicide formed by deposition, e.g. sputter deposition, i.e. without a silicidation reaction (H01L 21/28052 takes precedence)}

NOTE

{To assess the coverage of groups H01L 21/28052 and H01L 21/28061, barrier layers, e.g. TaSiN, are not considered. }

H01L 21/2807 {the final conductor layer next to the insulator being Si or Ge or C and their alloys except Si}

H01L 21/28079 {the final conductor layer next to the insulator being a single metal, e.g. Ta, W, Mo, Al}

H01L 21/28088 {the final conductor layer next to the insulator being a composite, e.g. TiN}

H01L 21/28097 {the final conductor layer next to the insulator being a metallic silicide}

H01L 21/28105 {the final conductor next to the insulator having a lateral composition or doping variation, or being formed laterally by more than one deposition step}

H01L 21/28114 {characterised by the sectional shape, e.g. T, inverted-T}

NOTE

{Documents are also classified in groups H01L 21/28035 - H01L 21/28105 when the composition is also relevant.}

H01L 21/28123 {Lithography-related aspects, e.g. sub-lithography lengths; Isolation-related aspects, e.g. to solve problems arising at the crossing with the side of the device isolation; Planarisation aspects}

H01L 21/28132 {conducting part of electrode is defined by a sidewall spacer or a similar technique, e.g. oxidation under mask, plating}

H01L 21/28141 {insulating part of the electrode is defined by a sidewall spacer, e.g. dummy spacer, or a similar technique, e.g. oxidation under mask, plating}

H01L 21/2815 {part or whole of the electrode is a sidewall spacer or made by a similar technique, e.g. transformation under mask, plating}

H01L 21/28158 {Making the insulator}

H01L 21/28167 {on single crystalline silicon, e.g. using a liquid, i.e. chemical oxidation}

H01L 21/28176 {with a treatment, e.g. annealing, after the formation of the definitive gate conductor}

H01L 21/28185 {with a treatment, e.g. annealing, after the formation of the gate insulator and before the formation of the definitive gate conductor}

H01L 21/28194 {by deposition, e.g. evaporation, ALD, CVD, sputtering, laser deposition (H01L 21/28202 takes precedence)}

H01L 21/28202 {in a nitrogen-containing ambient, e.g. nitride deposition, growth, oxynitridation, NH₃ nitridation, N₂O oxidation, thermal nitridation, RTN, plasma nitridation, RPN}

H01L 21/28211 {in a gaseous ambient using an oxygen or a water vapour, e.g. RTO, possibly through a layer (H01L 21/28194 and H01L 21/28202 take precedence)}

NOTE

{Thin oxidation layers used as a barrier layer or as a buffer layer, e.g. before the formation of a high-k insulator, are classified here only if important per se.}

H01L 21/2822 {with substrate doping, e.g. N, Ge, C implantation, before formation of the insulator}

H01L 21/28229 {by deposition of a layer, e.g. metal, metal compound or polysilicon, followed by transformation thereof into an insulating layer}

H01L 21/28238 {with sacrificial oxide}

H01L 21/28247 {passivation or protection of the electrode, e.g. using re-oxidation}

H01L 21/28255 {the insulator being formed after the semiconductor body, the semiconductor belonging to Group IV and not being elemental silicon, e.g. Ge, SiGe, SiGeC}

H01L 21/28264 {the insulator being formed after the semiconductor body, the semiconductor being a III-V compound}

H01L 21/283 Deposition of conductive or insulating materials for electrodes {conducting electric current}

H01L 21/285 from a gas or vapour, e.g. condensation

H01L 21/28506 {of conductive layers}

H01L 21/28512 {on semiconductor bodies comprising elements of Group IV of the Periodic Table}

H01L 21/28518 {the conductive layers comprising silicides (H01L 21/28537 takes precedence)}

H01L 21/28525 {the conductive layers comprising semiconducting material (H01L 21/28518, H01L 21/28537 take precedence)}

H01L 21/28531 {Making of side-wall contacts}

H01L 21/28537 {Deposition of Schottky electrodes}

H01L 21/2855 {by physical means, e.g. sputtering, evaporation (H01L 21/28518 - H01L 21/28537 and H01L 21/28568 take precedence)}

H01L 21/28556 {by chemical means, e.g. CVD, LPCVD, PECVD, laser CVD (H01L 21/28518 - H01L 21/28537 and H01L 21/28568 take precedence)}

H01L 21/28562 {Selective deposition}

H01L 21/28568 {the conductive layers comprising transition metals (H01L 21/28518 takes precedence)}

H01L 21/28575 {on semiconductor bodies comprising A_{III}B_V compounds}

H01L 21/28581 {Deposition of Schottky electrodes}

H01L 21/28587 {characterised by the sectional shape, e.g. T, inverted T}

H01L 21/28593 {asymmetrical sectional shape}

H01L 21/288 from a liquid, e.g. electrolytic deposition

H01L 21/2885 {using an external electrical current, i.e. electro-deposition}

H01L 21/30 Treatment of semiconductor bodies using processes or apparatus not provided for in groups H01L 21/20 - H01L 21/26 (manufacture of electrodes thereon H01L 21/28)

H01L 21/3003 {Hydrogenation or deuteration, e.g. using atomic hydrogen from a plasma}

H01L 21/3006 {of A_{III}B_V compounds}

H01L 21/302 to change their surface-physical characteristics or shape, e.g. etching, polishing, cutting

H01L 21/304 Mechanical treatment, e.g. grinding, polishing, cutting {(H01L 21/30625 takes precedence)}

H01L 21/3043 {Making grooves, e.g. cutting}

H01L 21/3046 {using blasting, e.g. sand-blasting (H01L 21/2633 takes precedence)}

H01L 21/306	 Chemical or electrical treatment, e.g. electrolytic etching (to form insulating layers H01L 21/31)
H01L 21/30604	 {Chemical etching}
H01L 21/30608	 {Anisotropic liquid etching (H01L 21/3063 takes precedence)}
H01L 21/30612	 {Etching of $A_{III}B_V$ compounds}
H01L 21/30617	 {Anisotropic liquid etching}
H01L 21/30621	 {Vapour phase etching}
H01L 21/30625	 {With simultaneous mechanical treatment, e.g. mechanico-chemical polishing}
H01L 21/3063	 Electrolytic etching
H01L 21/30635	 {of $A_{III}B_V$ compounds}
H01L 21/3065	 Plasma etching; Reactive-ion etching
H01L 21/30655	 {comprising alternated and repeated etching and passivation steps, e.g. Bosch process}
H01L 21/308	 using masks (H01L 21/3063 , H01L 21/3065 take precedence)
H01L 21/3081	 {characterised by their composition, e.g. multilayer masks, materials}
H01L 21/3083	 {characterised by their size, orientation, disposition, behaviour, shape, in horizontal or vertical plane}
H01L 21/3085	 {characterised by their behaviour during the process, e.g. soluble masks, redeposited masks}
H01L 21/3086	 {characterised by the process involved to create the mask, e.g. lift-off masks, sidewalls, or to modify the mask, e.g. pre-treatment, post-treatment}
H01L 21/3088	 {Process specially adapted to improve the resolution of the mask}
H01L 21/31	 to form insulating layers thereon, e.g. for masking or by using photolithographic techniques (encapsulating layers H01L 21/56); After treatment of these layers; Selection of materials for these layers
H01L 21/3105	 After-treatment
H01L 21/31051	 {Planarisation of the insulating layers (H01L 21/31058 takes precedence)}
H01L 21/31053	 {involving a dielectric removal step}
H01L 21/31055	 {the removal being a chemical etching step, e.g. dry etching (etching <u>per se</u> H01L 21/311)}
H01L 21/31056	 {the removal being a selective chemical etching step, e.g. selective dry etching through a mask}
H01L 21/31058	 {of organic layers}
H01L 21/311	 Etching the insulating layers {by chemical or physical means (H01L 21/31058 takes precedence)}
H01L 21/31105	 {Etching inorganic layers}
H01L 21/31111	 {by chemical means}
H01L 21/31116	 {by dry-etching}
H01L 21/31122	 {of layers not containing Si, e.g. PZT, Al_2O_3 }
H01L 21/31127	 {Etching organic layers}
H01L 21/31133	 {by chemical means}
H01L 21/31138	 {by dry-etching}
H01L 21/31144	 {using masks}
H01L 21/3115	 Doping the insulating layers
H01L 21/31155	 {by ion implantation}

H01L 21/312
(Frozen)

. Organic layers, e.g. photoresist (H01L 21/3105, H01L 21/32 take precedence; {photoresists per se G03C})

WARNING

Groups H01L 21/312 – H01L 21/3128 are no longer used for the classification of documents as of May 1, 2011. The content of these groups is being reclassified into groups H01L 21/02107 – H01L 21/02326.
Groups H01L 21/02107 – H01L 21/02326 should be considered in order to perform a complete search.

H01L 21/3121
(Frozen)

. {Layers comprising organo-silicon compounds}

H01L 21/3122
(Frozen)

. {layers comprising polysiloxane compounds}

H01L 21/3124
(Frozen)

. {layers comprising hydrogen silsesquioxane}

H01L 21/3125
(Frozen)

. {layers comprising silazane compounds}

H01L 21/3127
(Frozen)

. {Layers comprising fluoro (hydro)carbon compounds, e.g. polytetrafluoroethylene}

H01L 21/3128
(Frozen)

. {by Langmuir-Blodgett techniques}

H01L 21/314
(Frozen)

. Inorganic layers (H01L 21/3105, H01L 21/32 take precedence)

WARNING

Groups H01L 21/314 – H01L 21/3185 are no longer used for the classification of documents as of May 1, 2011. The content of these group is being reclassified into group H01L 21/02107 – H01L 21/02326.
Groups H01L 21/02107 – H01L 21/02326 should be considered in order to perform a complete search.

H01L 21/3141
(Frozen)

. {Deposition using atomic layer deposition techniques [ALD]}

H01L 21/3142
(Frozen)

. {of nano-laminates, e.g. alternating layers of Al₂O₃-HfO₂}

H01L 21/3143
(Frozen)

. {composed of alternated layers or of mixtures of nitrides and oxides or of oxinitrides, e.g. formation of oxinitride by oxidation of nitride layers}

H01L 21/3144
(Frozen)

. {on silicon}

H01L 21/3145
(Frozen)

. {formed by deposition from a gas or vapour}

H01L 21/3146
(Frozen)

. {Carbon layers, e.g. diamond-like layers}

H01L 21/3147
(Frozen)

. {Epitaxial deposition of insulating materials}

H01L 21/3148
(Frozen)

. {Silicon Carbide layers}

H01L 2021/3149
(Frozen)

. {Langmuir-Blodgett techniques}

H01L 21/316
(Frozen)

. composed of oxides or glassy oxides or oxide based glass

WARNING

Group H01L 21/316 is no longer used for the classification of documents as of May 1, 2011. The content of this group is being reclassified into groups H01L 21/02107 – H01L 21/02326.
Groups H01L 21/02107 – H01L 21/02326 should be considered in order to perform a complete search.

H01L 21/31604
(Frozen)

. {Deposition from a gas or vapour (H01L 21/31691, H01L 21/31695 take precedence)}

H01L 21/31608 (Frozen)	 {Deposition of SiO ₂ (H01L 21/31625, H01L 21/31629 and H01L 21/31633 take precedence)}
H01L 21/31612 (Frozen)	 {on a silicon body}
H01L 21/31616 (Frozen)	 {Deposition of Al ₂ O ₃ }
H01L 21/3162 (Frozen)	 {on a silicon body}
H01L 21/31625 (Frozen)	 {Deposition of boron or phosphorus doped silicon oxide, e.g. BSG, PSG, BPSG}
H01L 21/31629 (Frozen)	 {Deposition of halogen doped silicon oxide, e.g. fluorine doped silicon oxide}
H01L 21/31633 (Frozen)	 {Deposition of carbon doped silicon oxide, e.g. SiOC}
H01L 21/31637 (Frozen)	 {Deposition of Tantalum oxides, e.g. Ta ₂ O ₅ }
H01L 21/31641 (Frozen)	 {Deposition of Zirconium oxides, e.g. ZrO ₂ }
H01L 21/31645 (Frozen)	 {Deposition of Hafnium oxides, e.g. HfO ₂ }
H01L 21/3165 (Frozen)	 {formed by oxidation (H01L 21/31691, H01L 21/31695 take precedence)}
H01L 21/31654 (Frozen)	 {of semiconductor materials, e.g. the body itself}
H01L 21/31658 (Frozen)	 {by thermal oxidation, e.g. of SiGe}
H01L 21/31662 (Frozen)	 {of silicon in uncombined form}
H01L 21/31666 (Frozen)	 {of AIII BV compounds}
H01L 21/3167 (Frozen)	 {of anodic oxidation}
H01L 21/31675 (Frozen)	 {of silicon}
H01L 21/31679 (Frozen)	 {of AIII BV compounds}
H01L 21/31683 (Frozen)	 {of metallic layers, e.g. Al deposited on the body, e.g. formation of multi-layer insulating structures}
H01L 21/31687 (Frozen)	 {by anodic oxidation}
H01L 21/31691 (Frozen)	 {with perovskite structure}
H01L 21/31695 (Frozen)	 {Deposition of porous oxides or porous glassy oxides or oxide based porous glass}
H01L 21/318 (Frozen)	 composed of nitrides

WARNING

Group H01L 21/318 is no longer used for the classification of documents as of May 1, 2011. The content of this group is being reclassified into groups H01L 21/02107 – H01L 21/02326.
Groups H01L 21/02107 – H01L 21/02326 should be considered in order to perform a complete search.

H01L 21/3185 (Frozen)	 {of siliconnitrides}
H01L 21/32	 using masks
H01L 21/3205	 Deposition of non-insulating-, e.g. conductive- or resistive-, layers on insulating layers; After-treatment of these layers (manufacture of electrodes H01L 21/28)
H01L 21/32051	 {Deposition of metallic or metal-silicide layers}
H01L 21/32053	 {of metal-silicide layers}
H01L 21/32055	 {Deposition of semiconductive layers, e.g. poly - or amorphous silicon layers}

H01L 21/32056	 {Deposition of conductive or semi-conductive organic layers (H01L 21/32058 takes precedence)}
H01L 21/32058	 {Deposition of superconductive layers}
H01L 21/321	 After treatment
H01L 21/32105	 {Oxidation of silicon-containing layers}
H01L 21/3211	 {Nitridation of silicon-containing layers}
H01L 21/32115	 {Planarisation}
H01L 21/3212	 {by chemical mechanical polishing [CMP]}
H01L 21/32125	 {by simultaneously passing an electrical current, i.e. electrochemical mechanical polishing, e.g. ECMP}
H01L 21/3213	 Physical or chemical etching of the layers, e.g. to produce a patterned layer from a pre-deposited extensive layer
H01L 21/32131	 {by physical means only}
H01L 21/32132	 {of silicon-containing layers}
H01L 21/32133	 {by chemical means only}
H01L 21/32134	 {by liquid etching only}
H01L 21/32135	 {by vapour etching only}
H01L 21/32136	 {using plasmas}
H01L 21/32137	 {of silicon-containing layers}
H01L 21/32138	 {pre- or post-treatments, e.g. anti-corrosion processes}
H01L 21/32139	 {using masks}
H01L 21/3215	 Doping the layers
H01L 21/32155	 {Doping polycrystalline - or amorphous silicon layers}
H01L 21/322	 to modify their internal properties, e.g. to produce internal imperfections
H01L 21/3221	 {of silicon bodies, e.g. for gettering}
H01L 21/3223	 {using cavities formed by hydrogen or noble gas ion implantation}
H01L 21/3225	 {Thermally inducing defects using oxygen present in the silicon body for intrinsic gettering (H01L 21/3226 takes precedence)}

NOTE

{Gettering using both extrinsic and intrinsic gettering techniques is classified in both H01L 21/3221 and H01L 21/3225.}

H01L 21/3226	 {of silicon on insulator}
H01L 21/3228	 {of A _{III} B _V compounds, e.g. to make them semi-insulating}
H01L 21/324	 Thermal treatment for modifying the properties of semiconductor bodies, e.g. annealing, sintering (H01L 21/20 - H01L 21/288 and H01L 21/302 - H01L 21/322 take precedence)
H01L 21/3242	 {for the formation of PN junctions without addition of impurities (H01L 21/22 takes precedence)}
H01L 21/3245	 {of A _{III} B _V compounds}
H01L 21/3247	 {for altering the shape, e.g. smoothing the surface}

WARNING

Group H01L 21/3247 is incomplete pending reclassification of documents from group H01L 21/324.
Groups H01L 21/324 and H01L 21/3247 should be considered in order to perform a complete search.

H01L 21/326	 Application of electric currents or fields, e.g. for electroforming (H01L 21/20 - H01L 21/288 and H01L 21/302 - H01L 21/324 take precedence)
H01L 21/34	. . . the devices having semiconductor bodies not provided for in groups H01L 21/18, H10D 48/04 and H10D 48/07, with or without impurities, e.g. doping materials
H01L 21/38	. . . Diffusion of impurity materials, e.g. doping materials, electrode materials, into or out of a semiconductor body, or between semiconductor regions

H01L 21/383	 using diffusion into or out of a solid from or into a gaseous phase
H01L 21/385	 using diffusion into or out of a solid from or into a solid phase, e.g. a doped oxide layer
H01L 21/388	 using diffusion into or out of a solid from or into a liquid phase, e.g. alloy diffusion processes
H01L 21/40	 Alloying of impurity materials, e.g. doping materials, electrode materials, with a semiconductor body
H01L 21/42	 Bombardment with radiation
H01L 21/423	 with high-energy radiation
H01L 21/425	 producing ion implantation
H01L 21/426	 using masks
H01L 21/428	 using electromagnetic radiation, e.g. laser radiation
H01L 21/44	 Manufacture of electrodes on semiconductor bodies using processes or apparatus not provided for in groups H01L 21/38 - H01L 21/428
H01L 21/441	 Deposition of conductive or insulating materials for electrodes
H01L 21/443	 from a gas or vapour, e.g. condensation
H01L 21/445	 from a liquid, e.g. electrolytic deposition
H01L 21/447	 involving the application of pressure, e.g. thermo-compression bonding
H01L 21/449	 involving the application of mechanical vibrations, e.g. ultrasonic vibrations
H01L 21/46	 Treatment of semiconductor bodies using processes or apparatus not provided for in groups H01L 21/428 (manufacture of electrodes thereon H01L 21/44)
H01L 21/461	 to change their surface-physical characteristics or shape, e.g. etching, polishing, cutting
H01L 21/463	 Mechanical treatment, e.g. grinding, ultrasonic treatment
H01L 21/465	 Chemical or electrical treatment, e.g. electrolytic etching (to form insulating layers H01L 21/469)
H01L 21/467	 using masks
H01L 21/469	 to form insulating layers thereon, e.g. for masking or by using photolithographic techniques (encapsulating layers H01L 21/56); After-treatment of these layers
H01L 21/47	 Organic layers, e.g. photoresist (H01L 21/475 , H01L 21/4757 take precedence)
H01L 21/471	 Inorganic layers (H01L 21/475 , H01L 21/4757 take precedence)
H01L 21/473	 composed of oxides or glassy oxides or oxide based glass
H01L 21/475	 using masks
H01L 21/4757	 After-treatment
H01L 21/47573	 {Etching the layer}
H01L 21/47576	 {Doping the layer}
H01L 21/4763	 Deposition of non-insulating, e.g. conductive -, resistive -, layers on insulating layers; After-treatment of these layers (manufacture of electrodes H01L 21/28 , { H01L 21/44 })
H01L 21/47635	 {After-treatment of these layers}
H01L 21/477	 Thermal treatment for modifying the properties of semiconductor bodies, e.g. annealing, sintering (H01L 21/38 - H01L 21/449 and H01L 21/461 - H01L 21/475 take precedence)
H01L 21/479	 Application of electric currents or fields, e.g. for electroforming (H01L 21/38 - H01L 21/449 and H01L 21/461 - H01L 21/475 take precedence)
H01L 21/48	. . . Manufacture or treatment of parts, e.g. containers, prior to assembly of the devices, using processes not provided for in a single one of the groups H01L 21/18 - H01L 21/326 or H10D 48/04 - H10D 48/07

NOTE

{In this group, the expression "treatment" covers also the removal of leads from parts.}

H01L 21/4803	. . . {Insulating or insulated parts, e.g. mountings, containers, diamond heatsinks (H01L 21/4846 takes precedence; printed circuit boards H05K 1/00)}
--------------	--

H01L 21/4807	 {Ceramic parts}
H01L 21/481	 {Insulating layers on insulating parts, with or without metallisation}
H01L 21/4814	 {Conductive parts}
H01L 21/4817	 {for containers, e.g. caps (H01L 21/4871 takes precedence)}
H01L 21/4821	 {Flat leads, e.g. lead frames with or without insulating supports}
H01L 21/4825	 {Connection or disconnection of other leads to or from flat leads, e.g. wires, bumps, other flat leads}
H01L 21/4828	 {Etching (etching for cleaning without patterning H01L 21/4835)}
H01L 21/4832	 {Etching a temporary substrate after encapsulation process to form leads}
H01L 21/4835	 {Cleaning, e.g. removing of solder}
H01L 21/4839	 {Assembly of a flat lead with an insulating support, e.g. for TAB}
H01L 21/4842	 {Mechanical treatment, e.g. punching, cutting, deforming, cold welding}
H01L 21/4846	 {Leads on or in insulating or insulated substrates, e.g. metallisation (H01L 21/4821 takes precedence; metallisation of ceramics in general C04B 41/51; printed circuits H05K 3/00)}
H01L 21/485	 {Adaptation of interconnections, e.g. engineering charges, repair techniques}
H01L 21/4853	 {Connection or disconnection of other leads to or from a metallisation, e.g. pins, wires, bumps}
H01L 21/4857	 {Multilayer substrates (multilayer metallisation on monolayer substrate H01L 21/4846)}
H01L 21/486	 {Via connections through the substrate with or without pins}
H01L 21/4864	 {Cleaning, e.g. removing of solder}
H01L 21/4867	 {Applying pastes or inks, e.g. screen printing (H01L 21/486 takes precedence)}
H01L 21/4871	 {Bases, plates or heatsinks}
H01L 21/4875	 {Connection or disconnection of other leads to or from bases or plates}
H01L 21/4878	 {Mechanical treatment, e.g. deforming}
H01L 21/4882	 {Assembly of heatsink parts}
H01L 21/4885	 {Wire-like parts or pins (wire ball formation B23K 20/00; methods related to connecting semiconductor or other solid state bodies H01L 24/00)}
H01L 21/4889	 {Connection or disconnection of other leads to or from wire-like parts, e.g. wires}
H01L 21/4892	 {Cleaning}
H01L 21/4896	 {Mechanical treatment, e.g. cutting, bending}
H01L 21/50	. . . Assembly of semiconductor devices using processes or apparatus not provided for in a single one of the groups H01L 21/18 - H01L 21/326 or H10D 48/04 - H10D 48/07 {e.g. sealing of a cap to a base of a container}

NOTE

{Arrangements for connecting or disconnecting semiconductor or other solid state bodies, or methods related thereto, other than those arrangements or methods covered by the following subgroups, are covered by H01L 24/00.}

H01L 21/52	 Mounting semiconductor bodies in containers
H01L 21/54	 Providing fillings in containers, e.g. gas fillings
H01L 21/56	 Encapsulations, e.g. encapsulation layers, coatings
H01L 21/561	 {Batch processing}
H01L 21/563	 {Encapsulation of active face of flip-chip device, e.g. underfilling or underencapsulation of flip-chip, encapsulation preform on chip or mounting substrate}
H01L 21/565	 {Moulds}
H01L 21/566	 {Release layers for moulds, e.g. release layers, layers against residue during moulding}

H01L 21/568	 {Temporary substrate used as encapsulation process aid (H01L 21/4832 and H01L 21/566 take precedence)}
H01L 21/60	 Attaching {or detaching} leads or other conductive members, to be used for carrying current to or from the device in operation
H01L 2021/60007	 {involving a soldering or an alloying process}
H01L 2021/60015	 {using plate connectors, e.g. layer, film}
H01L 2021/60022	 {using bump connectors, e.g. for flip chip mounting}
H01L 2021/6003	 {Apparatus therefor}
H01L 2021/60037	 {Right-up bonding}
H01L 2021/60045	 {Pre-treatment step of the bump connectors prior to bonding}
H01L 2021/60052	 {Oxide removing step, e.g. flux, rosin}
H01L 2021/6006	 {with temporary supporting member not part of an apparatus, e.g. removable coating, film or substrate}
H01L 2021/60067	 {Aligning the bump connectors with the mounting substrate}
H01L 2021/60075	 {involving active alignment, i.e. by apparatus steering, e.g. using alignment marks, sensors}
H01L 2021/60082	 {involving passive alignment, e.g. using surface energy, chemical reactions, thermal equilibrium}
H01L 2021/6009	 {involving guiding structures, e.g. structures that are left at least partly in the bonded product, spacers}
H01L 2021/60097	 {Applying energy, e.g. for the soldering or alloying process}
H01L 2021/60105	 {using electromagnetic radiation}
H01L 2021/60112	 {Coherent radiation, i.e. laser beam}
H01L 2021/6012	 {Incoherent radiation, e.g. polychromatic heating lamp}
H01L 2021/60127	 {Induction heating, i.e. eddy currents}
H01L 2021/60135	 {using convection, e.g. reflow oven}
H01L 2021/60142	 {with a graded temperature profile}
H01L 2021/6015	 {using conduction, e.g. chuck heater, thermocompression}
H01L 2021/60157	 {with a graded temperature profile}
H01L 2021/60165	 {using an electron beam}
H01L 2021/60172	 {using static pressure}
H01L 2021/6018	 {Unidirectional static pressure}
H01L 2021/60187	 {Isostatic pressure, e.g. degassing using vacuum or pressurised liquid}
H01L 2021/60195	 {using dynamic pressure, e.g. ultrasonic or thermosonic bonding}
H01L 2021/60202	 {using a protective atmosphere, e.g. with forming or shielding gas}
H01L 2021/6021	 {using an autocatalytic reaction}
H01L 2021/60217	 {Detaching bump connectors, e.g. after testing}
H01L 2021/60225	 {Arrangement of bump connectors prior to mounting}
H01L 2021/60232	 {wherein the bump connectors are disposed only on the semiconductor chip}
H01L 2021/6024	 {wherein the bump connectors are disposed only on the mounting substrate}
H01L 2021/60247	 {wherein the bump connectors are disposed on both the semiconductor chip and the mounting substrate, e.g. bump to bump}
H01L 2021/60255	 {wherein the bump connectors are provided as prepeg, e.g. are provided in an insulating plate member}
H01L 2021/60262	 {Lateral distribution of bump connectors prior to mounting}
H01L 2021/6027	 {Mounting on semiconductor conductive members}
H01L 2021/60277	 {involving the use of conductive adhesives}
H01L 2021/60285	 {involving the use of mechanical auxiliary parts without the use of an alloying or soldering process, e.g. pressure contacts}
H01L 2021/60292	 {involving the use of an electron or laser beam}
H01L 21/603	 involving the application of pressure, e.g. thermo-compression bonding (H01L 21/607 takes precedence)

- H01L 21/607 involving the application of mechanical vibrations, e.g. ultrasonic vibrations
- H01L 21/62 . . the devices having no potential barriers
- H01L 21/64 . Manufacture or treatment of solid state devices other than semiconductor devices, or of parts thereof, not peculiar to a single device provided for in subclasses H10F, H10H, H10K or H10N
- H01L 21/67 . Apparatus specially adapted for handling semiconductor or electric solid state devices during manufacture or treatment thereof; Apparatus specially adapted for handling wafers during manufacture or treatment of semiconductor or electric solid state devices or components {; Apparatus not specifically provided for elsewhere (processes per se H01L 21/30, H01L 21/46, H01L 23/00; simple temporary support means, e.g. using adhesives, electric or magnetic means H01L 21/68, H01L 21/302; apparatus for manufacturing arrangements for connecting or disconnecting semiconductor or solid-state bodies and for methods related thereto H01L 24/74;)}

NOTE

{In this subgroup the term substrate designates a semiconductor or electric solid state device or component, or a wafer.}

- H01L 21/67005 . . {Apparatus not specifically provided for elsewhere (processes per se H01L 21/30, H01L 21/46, H01L 23/00; simple temporary support means, e.g. using adhesives, electric or magnetic means H01L 21/68, H01L 21/302)}
- H01L 21/67011 . . . {Apparatus for manufacture or treatment (processes H01L 21/30, H01L 21/46; for production or after-treatment of single crystals or homogeneous polycrystalline material C30B 35/00)}
- H01L 21/67017 {Apparatus for fluid treatment (H01L 21/67126, H01L 21/6715 take precedence)}
- H01L 21/67023 {for general liquid treatment, e.g. etching followed by cleaning}
- H01L 21/67028 {for cleaning followed by drying, rinsing, stripping, blasting or the like}
- H01L 21/67034 {for drying}
- H01L 21/6704 {for wet cleaning or washing}
- H01L 21/67046 {using mainly scrubbing means, e.g. brushes}
- H01L 21/67051 {using mainly spraying means, e.g. nozzles}
- H01L 21/67057 {with the semiconductor substrates being dipped in baths or vessels}
- H01L 21/67063 {for etching}
- H01L 21/67069 {for drying etching}
- H01L 21/67075 {for wet etching}
- H01L 21/6708 {using mainly spraying means, e.g. nozzles}
- H01L 21/67086 {with the semiconductor substrates being dipped in baths or vessels}
- H01L 21/67092 {Apparatus for mechanical treatment (or grinding or cutting, see the relevant groups in subclasses B24B or B28D)}
- H01L 21/67098 {Apparatus for thermal treatment}
- H01L 21/67103 {mainly by conduction}
- H01L 21/67109 {mainly by convection}
- H01L 21/67115 {mainly by radiation}
- H01L 21/67121 {Apparatus for making assemblies not otherwise provided for, e.g. package constructions}
- H01L 21/67126 {Apparatus for sealing, encapsulating, glassing, decapsulating or the like (processes H01L 23/02, H01L 23/28)}
- H01L 21/67132 {Apparatus for placing on an insulating substrate, e.g. tape}
- H01L 21/67138 {Apparatus for wiring semiconductor or solid state device}
- H01L 21/67144 {Apparatus for mounting on conductive members, e.g. leadframes or conductors on insulating substrates}
- H01L 21/6715 {Apparatus for applying a liquid, a resin, an ink or the like (H01L 21/67126 takes precedence)}

H01L 21/67155	 {Apparatus for manufacturing or treating in a plurality of work-stations}
H01L 21/67161	 {characterized by the layout of the process chambers}
H01L 21/67167	 {surrounding a central transfer chamber}
H01L 21/67173	 {in-line arrangement}
H01L 21/67178	 {vertical arrangement}
H01L 21/67184	 {characterized by the presence of more than one transfer chamber}
H01L 21/6719	 {characterized by the construction of the processing chambers, e.g. modular processing chambers}
H01L 21/67196	 {characterized by the construction of the transfer chamber}
H01L 21/67201	 {characterized by the construction of the load-lock chamber}
H01L 21/67207	 {comprising a chamber adapted to a particular process}
H01L 21/67213	 {comprising at least one ion or electron beam chamber (coating by ion implantation C23C ; ion or electron beam tubes H01J 37/00)}
H01L 21/67219	 {comprising at least one polishing chamber (polishing apparatuses B24B)}
H01L 21/67225	 {comprising at least one lithography chamber (lithographic apparatuses G03F 7/00)}
H01L 21/6723	 {comprising at least one plating chamber (electroless plating apparatuses C23C , electroplating apparatuses C25D)}
H01L 21/67236	 {the substrates being processed being not semiconductor wafers, e.g. leadframes or chips}
H01L 21/67242	. . . {Apparatus for monitoring, sorting or marking (testing or measuring during manufacture H01L 22/00 , marks <u>per se</u> H01L 23/544 ; testing individual semiconductor devices G01R 31/26)}
H01L 21/67248	 {Temperature monitoring}
H01L 21/67253	 {Process monitoring, e.g. flow or thickness monitoring}
H01L 21/67259	 {Position monitoring, e.g. misposition detection or presence detection}
H01L 21/67265	 {of substrates stored in a container, a magazine, a carrier, a boat or the like}
H01L 21/67271	 {Sorting devices}
H01L 21/67276	 {Production flow monitoring, e.g. for increasing throughput (program-control systems <u>per se</u> G05B 19/00 , e.g. total factory control G05B 19/418)}
H01L 21/67282	 {Marking devices}
H01L 21/67288	 {Monitoring of warpage, curvature, damage, defects or the like}
H01L 21/67294	 {using identification means, e.g. labels on substrates or labels on containers}
H01L 21/673	. . using specially adapted carriers {or holders; Fixing the workpieces on such carriers or holders (holders for supporting a complete device in operation H01L 23/32)}
H01L 21/67303	. . . {Vertical boat type carrier whereby the substrates are horizontally supported, e.g. comprising rod-shaped elements}
H01L 21/67306	 {characterized by a material, a roughness, a coating or the like}
H01L 21/67309	 {characterized by the substrate support}
H01L 21/67313	. . . {Horizontal boat type carrier whereby the substrates are vertically supported, e.g. comprising rod-shaped elements}
H01L 21/67316	 {characterized by a material, a roughness, a coating or the like}
H01L 21/6732	. . . {Vertical carrier comprising wall type elements whereby the substrates are horizontally supported, e.g. comprising sidewalls}
H01L 21/67323	 {characterized by a material, a roughness, a coating or the like}
H01L 21/67326	. . . {Horizontal carrier comprising wall type elements whereby the substrates are vertically supported, e.g. comprising sidewalls}
H01L 21/6733	 {characterized by a material, a roughness, a coating or the like}
H01L 21/67333	. . . {Trays for chips (magazine for components H05K 13/0084)}
H01L 21/67336	 {characterized by a material, a roughness, a coating or the like}

H01L 21/6734	. . . {specially adapted for supporting large square shaped substrates (containers and packaging elements for glass sheets B65D 85/48 , transporting of glass products during their manufacture C03B 35/00)}
H01L 21/67343	 {characterized by a material, a roughness, a coating or the like}
H01L 21/67346	. . . {characterized by being specially adapted for supporting a single substrate or by comprising a stack of such individual supports}
H01L 21/6735	. . . {Closed carriers}
H01L 21/67353	 {specially adapted for a single substrate}
H01L 21/67356	 {specially adapted for containing chips, dies or ICs}
H01L 21/67359	 {specially adapted for containing masks, reticles or pellicles}
H01L 21/67363	 {specially adapted for containing substrates other than wafers (H01L 21/67356 , H01L 21/67359 take precedence)}
H01L 21/67366	 {characterised by materials, roughness, coatings or the like (materials relating to an injection moulding process B29C 45/00 ; chemical composition of materials C08L 51/00)}
H01L 21/67369	 {characterised by shock absorbing elements, e.g. retainers or cushions}
H01L 21/67373	 {characterised by locking systems}
H01L 21/67376	 {characterised by sealing arrangements}
H01L 21/67379	 {characterised by coupling elements, kinematic members, handles or elements to be externally gripped}
H01L 21/67383	 {characterised by substrate supports}
H01L 21/67386	 {characterised by the construction of the closed carrier}
H01L 21/67389	 {characterised by atmosphere control}
H01L 21/67393	 {characterised by the presence of atmosphere modifying elements inside or attached to the closed carrier}
H01L 21/67396	 {characterised by the presence of antistatic elements}
H01L 21/677	. . for conveying, e.g. between different workstations
H01L 21/67703	. . . {between different workstations}
H01L 21/67706	 {Mechanical details, e.g. roller, belt (H01L 21/67709 takes precedence)}
H01L 21/67709	 {using magnetic elements}
H01L 21/67712	 {the substrate being handled substantially vertically}
H01L 21/67715	 {Changing the direction of the conveying path}
H01L 21/67718	 {Changing orientation of the substrate, e.g. from a horizontal position to a vertical position}
H01L 21/67721	 {the substrates to be conveyed not being semiconductor wafers or large planar substrates, e.g. chips, lead frames (H01L 21/6773 takes precedence)}
H01L 21/67724	 {by means of a cart or a vehicle}
H01L 21/67727	 {using a general scheme of a conveying path within a factory}
H01L 21/6773	 {Conveying cassettes, containers or carriers}
H01L 21/67733	 {Overhead conveying}
H01L 21/67736	 {Loading to or unloading from a conveyor}
H01L 21/67739	. . . {into and out of processing chamber}
H01L 21/67742	 {Mechanical parts of transfer devices (robots in general in B25J)}
H01L 21/67745	 {characterized by movements or sequence of movements of transfer devices}
H01L 21/67748	 {horizontal transfer of a single workpiece}
H01L 21/67751	 {vertical transfer of a single workpiece}
H01L 21/67754	 {horizontal transfer of a batch of workpieces}
H01L 21/67757	 {vertical transfer of a batch of workpieces}
H01L 21/6776	 {Continuous loading and unloading into and out of a processing chamber, e.g. transporting belts within processing chambers}
H01L 21/67763	. . . {the wafers being stored in a carrier, involving loading and unloading (H01L 21/6779 takes precedence)}
H01L 21/67766	 {Mechanical parts of transfer devices (robots in general in B25J)}
H01L 21/67769	 {Storage means}

H01L 21/67772	 {involving removal of lid, door, cover}
H01L 21/67775	 {Docking arrangements}
H01L 21/67778	 {involving loading and unloading of wafers}
H01L 21/67781	 {Batch transfer of wafers}
H01L 21/67784	. . . {using air tracks}
H01L 21/67787	 {with angular orientation of the workpieces}
H01L 21/6779	 {the workpieces being stored in a carrier, involving loading and unloading}
H01L 21/67793	. . . {with orientating and positioning by means of a vibratory bowl or track}
H01L 21/67796	. . . {with angular orientation of workpieces (H01L 21/67787 and H01L 21/67793 take precedence)}
H01L 21/68	. . for positioning, orientation or alignment
H01L 21/681	. . . {using optical controlling means}
H01L 21/682	. . . {Mask-wafer alignment (in general G03F 7/70, G03F 9/70)}
H01L 21/683	. . for supporting or gripping (for conveying H01L 21/677, for positioning, orientation or alignment H01L 21/68)
H01L 21/6831	. . . {using electrostatic chucks}
H01L 21/6833	 {Details of electrostatic chucks}
H01L 21/6835	. . . {using temporarily an auxiliary support}

NOTE

{H01L 21/6835, details of the apparatus are to be further indexed using the indexing codes chosen from H01L 2221/68304 and subgroups.}

H01L 21/6836	 {Wafer tapes, e.g. grinding or dicing support tapes (adhesive tapes in general C09J 7/20)}
H01L 21/6838	. . . {with gripping and holding devices using a vacuum; Bernoulli devices}
H01L 21/687	. . . using mechanical means, e.g. chucks, clamps or pinches {(using electrostatic chucks H01L 21/6831)}
H01L 21/68707	 {the wafers being placed on a robot blade, or gripped by a gripper for conveyance}
H01L 21/68714	 {the wafers being placed on a susceptor, stage or support}
H01L 21/68721	 {characterised by edge clamping, e.g. clamping ring}
H01L 21/68728	 {characterised by a plurality of separate clamping members, e.g. clamping fingers}
H01L 21/68735	 {characterised by edge profile or support profile}
H01L 21/68742	 {characterised by a lifting arrangement, e.g. lift pins}
H01L 21/6875	 {characterised by a plurality of individual support members, e.g. support posts or protrusions}
H01L 21/68757	 {characterised by a coating or a hardness or a material}
H01L 21/68764	 {characterised by a movable susceptor, stage or support, others than those only rotating on their own vertical axis, e.g. susceptors on a rotating carousel}
H01L 21/68771	 {characterised by supporting more than one semiconductor substrate}
H01L 21/68778	 {characterised by supporting substrates others than wafers, e.g. chips}
H01L 21/68785	 {characterised by the mechanical construction of the susceptor, stage or support}
H01L 21/68792	 {characterised by the construction of the shaft}
H01L 21/70	. Manufacture or treatment of devices consisting of a plurality of solid state components formed in or on a common substrate or of parts thereof; Manufacture of integrated circuit devices or of parts thereof ({multistep manufacturing processes of assemblies consisting of a plurality of individual semiconductor or other solid state devices H01L 25/00; } manufacture of assemblies consisting of preformed electrical components H05K 3/00, H05K 13/00)
H01L 21/702	. . {of thick-or thin-film circuits or parts thereof}
H01L 21/705	. . . {of thick-film circuits or parts thereof}
H01L 21/707	. . . {of thin-film circuits or parts thereof}

H01L 21/71	. . Manufacture of specific parts of devices defined in group H01L 21/70 ({H01L 21/0405, H01L 21/0445} , H01L 21/28, H01L 21/44, H01L 21/48 take precedence)
H01L 21/74	. . . Making of {localized} buried regions, e.g. buried collector layers, internal connections {substrate contacts}
H01L 21/743	 {Making of internal connections, substrate contacts}
H01L 21/746	 {for AIII-BV integrated circuits}
H01L 21/76	. . . Making of isolation regions between components
H01L 21/7602	 {between components manufactured in an active substrate comprising SiC compounds}
H01L 21/7605	 {between components manufactured in an active substrate comprising AIII BV compounds}
H01L 21/7607	 {between components manufactured in an active substrate comprising A _{III} B _{VI} compounds}
H01L 21/761	 PN junctions
H01L 21/762	 Dielectric regions {, e.g. EPIC dielectric isolation, LOCOS; Trench refilling techniques, SOI technology, use of channel stoppers}
H01L 21/76202	 {using a local oxidation of silicon, e.g. LOCOS, SWAMI, SILO (H01L 21/76235 takes precedence; together with vertical isolation, e.g. LOCOS in a SOI substrate, H01L 21/76264)}
H01L 21/76205	 {in a region being recessed from the surface, e.g. in a recess, groove, tub or trench region}
H01L 21/76208	 {using auxiliary pillars in the recessed region, e.g. to form LOCOS over extended areas}
H01L 21/7621	 {the recessed region having a shape other than rectangular, e.g. rounded or oblique shape (H01L 21/76208 takes precedence)}
H01L 21/76213	 {introducing electrical inactive or active impurities in the local oxidation region, e.g. to alter LOCOS oxide growth characteristics or for additional isolation purpose}
H01L 21/76216	 {introducing electrical active impurities in the local oxidation region for the sole purpose of creating channel stoppers}
H01L 21/76218	 {introducing both types of electrical active impurities in the local oxidation region for the sole purpose of creating channel stoppers, e.g. for isolation of complementary doped regions}
H01L 21/76221	 {with a plurality of successive local oxidation steps}
H01L 21/76224	 {using trench refilling with dielectric materials (trench filling with polycrystalline silicon H01L 21/763; together with vertical isolation, e.g. trench refilling in a SOI substrate H01L 21/76264)}
H01L 21/76227	 {the dielectric materials being obtained by full chemical transformation of non-dielectric materials, such as polycrystalline silicon, metals}
H01L 21/76229	 {Concurrent filling of a plurality of trenches having a different trench shape or dimension, e.g. rectangular and V-shaped trenches, wide and narrow trenches, shallow and deep trenches}
H01L 21/76232	 {of trenches having a shape other than rectangular or V-shape, e.g. rounded corners, oblique or rounded trench walls (H01L 21/76229 takes precedence)}
H01L 21/76235	 {trench shape altered by a local oxidation of silicon process step, e.g. trench corner rounding by LOCOS}
H01L 21/76237	 {introducing impurities in trench side or bottom walls, e.g. for forming channel stoppers or alter isolation behavior}
H01L 21/7624	 {using semiconductor on insulator [SOI] technology}
H01L 21/76243	 {using silicon implanted buried insulating layers, e.g. oxide layers, i.e. SIMOX techniques}
H01L 21/76245	 {using full isolation by porous oxide silicon, i.e. FIPOS techniques}
H01L 21/76248	 {using lateral overgrowth techniques, i.e. ELO techniques}
H01L 21/76251	 {using bonding techniques}
H01L 21/76254	 {with separation/delamination along an ion implanted layer, e.g. Smart-cut, Unibond}
H01L 21/76256	 {using silicon etch back techniques, e.g. BESOI, ELTRAN}
H01L 21/76259	 {with separation/delamination along a porous layer}
H01L 21/76262	 {using selective deposition of single crystal silicon, i.e. SEG techniques}

H01L 21/76264	 {SOI together with lateral isolation, e.g. using local oxidation of silicon, or dielectric or polycrystalline material refilled trench or air gap isolation regions, e.g. completely isolated semiconductor islands}
H01L 21/76267	 {Vertical isolation by silicon implanted buried insulating layers, e.g. oxide layers, i.e. SIMOX techniques}
H01L 21/7627	 {Vertical isolation by full isolation by porous oxide silicon, i.e. FIPOS techniques}
H01L 21/76272	 {Vertical isolation by lateral overgrowth techniques, i.e. ELO techniques}
H01L 21/76275	 {Vertical isolation by bonding techniques}
H01L 21/76278	 {Vertical isolation by selective deposition of single crystal silicon, i.e. SEG techniques}
H01L 21/76281	 {Lateral isolation by selective oxidation of silicon}
H01L 21/76283	 {Lateral isolation by refilling of trenches with dielectric material}
H01L 21/76286	 {Lateral isolation by refilling of trenches with polycrystalline material}
H01L 21/76289	 {Lateral isolation by air gap}
H01L 21/76291	 {Lateral isolation by field effect}
H01L 21/76294	 {using selective deposition of single crystal silicon, i.e. SEG techniques}
H01L 21/76297	 {Dielectric isolation using EPIC techniques, i.e. epitaxial passivated integrated circuit}
H01L 21/763	 Polycrystalline semiconductor regions {(H01L 21/76264 takes precedence)}
H01L 21/764	 Air gaps {(H01L 21/76264 takes precedence)}
H01L 21/765	 by field effect {(H01L 21/76264 takes precedence)}
H01L 21/768	. . . Applying interconnections to be used for carrying current between separate components within a device {comprising conductors and dielectrics}

NOTE

{Groups H01L 21/768 - H01L 21/76898 cover multi-step processes for manufacturing interconnections. Information peculiar to single-step processes should also be classified in the corresponding group, e.g.

- cleaning H01L 21/02041
- etching H01L 21/311, H01L 21/3213
- masking H01L 21/027, H01L 21/033, H01L 21/31144, H01L 21/32139
- planarizing H01L 21/3105, H01L 21/321.

}

H01L 21/76801	 {characterised by the formation and the after-treatment of the dielectrics, e.g. smoothing}
H01L 21/76802	 {by forming openings in dielectrics}
H01L 21/76804	 {by forming tapered via holes}
H01L 21/76805	 {the opening being a via or contact hole penetrating the underlying conductor}
H01L 21/76807	 {for dual damascene structures}
H01L 21/76808	 {involving intermediate temporary filling with material}
H01L 21/7681	 {involving one or more buried masks}
H01L 21/76811	 {involving multiple stacked pre-patterned masks}
H01L 21/76813	 {involving a partial via etch}
H01L 21/76814	 {post-treatment or after-treatment, e.g. cleaning or removal of oxides on underlying conductors}
H01L 21/76816	 {Aspects relating to the layout of the pattern or to the size of vias or trenches (layout of the interconnections <u>per se</u> H01L 23/528; CAD of ICs G06F 30/00)}
H01L 21/76817	 {using printing or stamping techniques}
H01L 21/76819	 {Smoothing of the dielectric (planarisation of insulating materials <u>per se</u> H01L 21/31051)}
H01L 21/7682	 {the dielectric comprising air gaps}

H01L 21/76822	 {Modification of the material of dielectric layers, e.g. grading, after-treatment to improve the stability of the layers, to increase their density etc.}
H01L 21/76823	 {transforming an insulating layer into a conductive layer}
H01L 21/76825	 {by exposing the layer to particle radiation, e.g. ion implantation, irradiation with UV light or electrons etc. (plasma treatment H01L 21/76826)}
H01L 21/76826	 {by contacting the layer with gases, liquids or plasmas}
H01L 21/76828	 {thermal treatment}
H01L 21/76829	 {characterised by the formation of thin functional dielectric layers, e.g. dielectric etch-stop, barrier, capping or liner layers}
H01L 21/76831	 {in via holes or trenches, e.g. non-conductive sidewall liners}
H01L 21/76832	 {Multiple layers}
H01L 21/76834	 {formation of thin insulating films on the sidewalls or on top of conductors (H01L 21/76831 takes precedence)}
H01L 21/76835	 {Combinations of two or more different dielectric layers having a low dielectric constant (H01L 21/76832 takes precedence)}
H01L 21/76837	 {Filling up the space between adjacent conductive structures; Gap-filling properties of dielectrics}
H01L 21/76838	 {characterised by the formation and the after-treatment of the conductors (etching for patterning the conductors H01L 21/3213)}

NOTE

{When the interconnect is also used as the conductor part of a conductor insulator semiconductor electrode (gate level interconnections), documents are classified in the relevant electrode manufacture groups, e.g. [H01L 21/28026](#)}.

H01L 21/7684	 {Smoothing; Planarisation}
H01L 21/76841	 {Barrier, adhesion or liner layers}
H01L 21/76843	 {formed in openings in a dielectric}
H01L 21/76844	 {Bottomless liners}
H01L 21/76846	 {Layer combinations}
H01L 21/76847	 {the layer being positioned within the main fill metal}
H01L 21/76849	 {the layer being positioned on top of the main fill metal}
H01L 21/7685	 {the layer covering a conductive structure (H01L 21/76849 takes precedence)}
H01L 21/76852	 {the layer also covering the sidewalls of the conductive structure}
H01L 21/76853	 {characterized by particular after-treatment steps}
H01L 21/76855	 {After-treatment introducing at least one additional element into the layer}
H01L 21/76856	 {by treatment in plasmas or gaseous environments, e.g. nitriding a refractory metal liner}
H01L 21/76858	 {by diffusing alloying elements}
H01L 21/76859	 {by ion implantation}
H01L 21/76861	 {Post-treatment or after-treatment not introducing additional chemical elements into the layer}
H01L 21/76862	 {Bombardment with particles, e.g. treatment in noble gas plasmas; UV irradiation}
H01L 21/76864	 {Thermal treatment}
H01L 21/76865	 {Selective removal of parts of the layer (H01L 21/76844 takes precedence)}
H01L 21/76867	 {characterized by methods of formation other than PVD, CVD or deposition from a liquids (PVD H01L 21/2855 ; CVD H01L 21/28556 ; deposition from liquids H01L 21/288)}
H01L 21/76868	 {Forming or treating discontinuous thin films, e.g. repair, enhancement or reinforcement of discontinuous thin films}
H01L 21/7687	 {Thin films associated with contacts of capacitors}
H01L 21/76871	 {Layers specifically deposited to enhance or enable the nucleation of further layers, i.e. seed layers}
H01L 21/76873	 {for electroplating}

H01L 21/76874	 {for electroless plating}
H01L 21/76876	 {for deposition from the gas phase, e.g. CVD}
H01L 21/76877	 {Filling of holes, grooves or trenches, e.g. vias, with conductive material}
H01L 21/76879	 {by selective deposition of conductive material in the vias, e.g. selective C.V.D. on semiconductor material, plating (plating on semiconductors in general H01L 21/288)}
H01L 21/7688	 {by deposition over sacrificial masking layer, e.g. lift-off (<u>lift-off per se</u> H01L 21/0272)}
H01L 21/76882	 {Reflowing or applying of pressure to better fill the contact hole}
H01L 21/76883	 {Post-treatment or after-treatment of the conductive material}
H01L 21/76885	 {By forming conductive members before deposition of protective insulating material, e.g. pillars, studs}
H01L 21/76886	 {Modifying permanently or temporarily the pattern or the conductivity of conductive members, e.g. formation of alloys, reduction of contact resistances}
H01L 21/76888	 {By rendering at least a portion of the conductor non conductive, e.g. oxidation}
H01L 21/76889	 {by forming silicides of refractory metals}
H01L 21/76891	 {by using superconducting materials}
H01L 21/76892	 {modifying the pattern}
H01L 21/76894	 {using a laser, e.g. laser cutting, laser direct writing, laser repair}
H01L 21/76895	 {Local interconnects; Local pads, as exemplified by patent document EP0896365}
H01L 21/76897	 {Formation of self-aligned vias or contact plugs, i.e. involving a lithographically uncritical step}
H01L 21/76898	 {formed through a semiconductor substrate}
H01L 21/77	. . Manufacture or treatment of devices consisting of a plurality of solid state components or integrated circuits formed in, or on, a common substrate (<u>manufacture or treatment of electronic memory devices</u> H10B)
H01L 21/78	. . . with subsequent division of the substrate into plural individual devices (<u>cutting to change the surface-physical characteristics or shape of semiconductor bodies</u> H01L 21/304)
H01L 21/7806	. . . {involving the separation of the active layers from a substrate}
H01L 21/7813	 {leaving a reusable substrate, e.g. epitaxial lift off}
H01L 22/00	{Testing or measuring during manufacture or treatment; Reliability measurements, i.e. testing of parts without further processing to modify the parts as such; Structural arrangements therefor}
H01L 22/10	. {Measuring as part of the manufacturing process (<u>burn-in</u> G01R 31/2855)}
H01L 22/12	. . {for structural parameters, e.g. thickness, line width, refractive index, temperature, warp, bond strength, defects, optical inspection, electrical measurement of structural dimensions, metallurgic measurement of diffusions (<u>electrical measurement of diffusions</u> H01L 22/14)}
H01L 22/14	. . {for electrical parameters, e.g. resistance, deep-levels, CV, diffusions by electrical means}
H01L 22/20	. {Sequence of activities consisting of a plurality of measurements, corrections, marking or sorting steps}
H01L 22/22	. . {Connection or disconnection of sub-entities or redundant parts of a device in response to a measurement (<u>testing and repair of stores after manufacture including at wafer scale</u> G11C 29/00 ; fuses <u>per se</u> H01L 23/525)}
H01L 22/24	. . {Optical enhancement of defects or not directly visible states, e.g. selective electrolytic deposition, bubbles in liquids, light emission, colour change (<u>voltage contrast</u> G01R 31/311)}
H01L 22/26	. . {Acting in response to an ongoing measurement without interruption of processing, e.g. endpoint detection, in-situ thickness measurement (<u>endpoint detection arrangements in CMP apparatus</u> B24B 37/013 , in discharge apparatus H01J 37/32)}
H01L 22/30	. {Structural arrangements specially adapted for testing or measuring during manufacture or treatment, or specially adapted for reliability measurements}

H01L 22/32

- . . {Additional lead-in metallisation on a device or substrate, e.g. additional pads or pad portions, lines in the scribe line, sacrificed conductors (arrangements for conducting electric current to or from the solid state body in operation H01L 23/48)}

H01L 22/34

- . . {Circuits for electrically characterising or monitoring manufacturing processes, e. g. whole test die, wafers filled with test structures, on-board-devices incorporated on each die, process control monitors or pad structures thereof, devices in scribe line (switching, multiplexing, gating devices G01R 19/25; process control with lithography, e.g. dose control, G03F 7/20; structures for alignment control by optical means G03F 7/70633)}