

CPC COOPERATIVE PATENT CLASSIFICATION

B PERFORMING OPERATIONS; TRANSPORTING

(NOTES omitted)

MICROSTRUCTURAL TECHNOLOGY; NANOTECHNOLOGY

B81 MICROSTRUCTURAL TECHNOLOGY

(NOTES omitted)

B81C PROCESSES OR APPARATUS SPECIALLY ADAPTED FOR THE MANUFACTURE OR TREATMENT OF MICROSTRUCTURAL DEVICES OR SYSTEMS (making microcapsules or microballoons [B01J 13/02](#); processes or apparatus peculiar to the manufacture or treatment of piezo-electric, electrostrictive or magnetostrictive element per se [H01L 41/22](#))

NOTES

- This subclass **does not cover**:
 - processes or apparatus for the manufacture or treatment of purely electrical or electronic devices, which are covered by section [H](#), e.g. group [H01L 21/00](#);
 - processes or apparatus involving the manipulation of single atoms or molecules, which are covered by group [B82B 3/00](#).
- In this subclass, local "residual" subgroups, e.g. [B81C 1/00126](#), are used with the following purpose.

When classifying a document which does not fit in any of a set of subgroups with the same dot-level, the document should be classified in the residual group, if present, and not in the group at the hierarchical level one dot above.

In the example, the document shall be classified in [B81C 1/00126](#) and not in [B81C 1/00023](#) as [B81C 1/00126](#) is "residual" to [B81C 1/00031](#)-[B81C 1/00119](#)

1/00	Manufacture or treatment of devices or systems in or on a substrate (B81C 3/00 takes precedence)	1/00119 . . . {Arrangement of basic structures like cavities or channels, e.g. suitable for microfluidic systems}
1/00007	. {Assembling automatically hinged components, i.e. self-assembly processes (self-assembly mechanisms B81B 7/0003)}	1/00126 . . . {Static structures not provided for in groups B81C 1/00031 - B81C 1/00119 }
1/00015	. {for manufacturing microsystems}	1/00134 . . {comprising flexible or deformable structures (manufacture of MEMS devices for specific applications, see relevant places, e.g. gyroscopes G01C 19/5719 , pressure sensors G01L 9/0042 , accelerometers G01P 15/0802 , acoustic transducers or diaphragms therefor H04R 31/00)}
1/00023	. . {without movable or flexible elements (array of static structures for functionalising surfaces in B81C 1/00206 ; manufacture of MEMS devices for specific applications, see relevant places, e.g. microreactors B01J 19/0093 , lab-on-chip B01L 3/5027 , micromixers B01F 13/0059)}	1/00142 . . . {Bridges (deformable micromirrors G02B 26/0841)}
1/00031	. . . {Regular or irregular arrays of nanoscale structures, e.g. etch mask layer (photomechanical, e.g. photolithographic, production of textured or patterned surfaces G03F 7/00 ; lithographic processes for making patterned surfaces using printing and stamping G03F 7/0002)}	1/0015 . . . {Cantilevers (switches using MEMS H01H 1/0036 ; electrostatic relays using micromechanics H01H 59/0009 ; microelectro-mechanical resonators H03H 9/02244)}
1/00039	. . . {Anchors}	1/00158 . . . {Diaphragms, membranes (manufacture process for semi-permeable inorganic membranes B01D 67/0039)}
1/00047	. . . {Cavities}	1/00166 . . . {Electrodes}
1/00055	. . . {Grooves}	1/00174 . . . {See-saws}
1/00063 {Trenches}	1/00182 . . . {Arrangements of deformable or non-deformable structures, e.g. membrane and cavity for use in a transducer}
1/00071 {Channels}	1/0019 . . . {Flexible or deformable structures not provided for in groups B81C 1/00142 - B81C 1/00182 }
1/00079 {Grooves not provided for in groups B81C 1/00063 - B81C 1/00071 }	1/00198 . . {comprising elements which are movable in relation to each other, e.g. comprising slidable or rotatable elements}
1/00087	. . . {Holes}	1/00206 . . {Processes for functionalising a surface, e.g. provide the surface with specific mechanical, chemical or biological properties}
1/00095	. . . {Interconnects}	
1/00103	. . . {Structures having a predefined profile, e.g. sloped or rounded grooves}	
1/00111	. . . {Tips, pillars, i.e. raised structures (microneedles A61M 37/0015)}	

- 1/00214 . . {Processes for the simultaneous manufacturing of a network or an array of similar microstructural devices}
- 1/00222 . . {Integrating an electronic processing unit with a micromechanical structure}
- 1/0023 . . . {Packaging together an electronic processing unit die and a micromechanical structure die (MEMS packages [B81B 7/0032](#); MEMS packaging processes [B81C 1/00261](#))}
- 1/00238 . . . {Joining a substrate with an electronic processing unit and a substrate with a micromechanical structure}
- 1/00246 . . . {Monolithic integration, i.e. micromechanical structure and electronic processing unit are integrated on the same substrate}
- 1/00253 . . . {Processes for integrating an electronic processing unit with a micromechanical structure not provided for in [B81C 1/0023](#) - [B81C 1/00246](#)}
- 1/00261 . . {Processes for packaging MEMS devices (MEMS packages [B81B 7/0032](#), packaging of smart-MEMS [B81C 1/0023](#))}
- 1/00269 . . . {Bonding of solid lids or wafers to the substrate}
- 1/00277 . . . {for maintaining a controlled atmosphere inside of the cavity containing the MEMS}
- 1/00285 {using materials for controlling the level of pressure, contaminants or moisture inside of the package, e.g. getters}
- 1/00293 {maintaining a controlled atmosphere with processes not provided for in [B81C 1/00285](#)}
- 1/00301 . . . {Connecting electric signal lines from the MEMS device with external electrical signal lines, e.g. through vias}
- 1/00309 . . . {suitable for fluid transfer from the MEMS out of the package or *vice versa*, e.g. transfer of liquid, gas, sound}
- 1/00317 . . . {Packaging optical devices}
- 1/00325 . . . {for reducing stress inside of the package structure}
- 1/00333 . . . {Aspects relating to packaging of MEMS devices, not covered by groups [B81C 1/00269](#) - [B81C 1/00325](#)}
- 1/00341 . . {Processes for manufacturing microsystems not provided for in groups [B81C 1/00023](#) - [B81C 1/00261](#)}
- 1/00349 . {Creating layers of material on a substrate}
- 1/00357 . . {involving bonding one or several substrates on a non-temporary support, e.g. another substrate}
- 1/00365 . . {having low tensile stress between layers}
- 1/00373 . . {Selective deposition, e.g. printing or microcontact printing}
- 1/0038 . . {Processes for creating layers of materials not provided for in groups [B81C 1/00357](#) - [B81C 1/00373](#)}
- 1/00388 . {Etch mask forming}
- 1/00396 . . {Mask characterised by its composition, e.g. multilayer masks}
- 1/00404 . . {Mask characterised by its size, orientation or shape}
- 1/00412 . . {Mask characterised by its behaviour during the etching process, e.g. soluble masks}
- 1/0042 . . {Compensation masks in orientation dependent etching}
- 1/00428 . . {Etch mask forming processes not provided for in groups [B81C 1/00396](#) - [B81C 1/0042](#)}
- 1/00436 . {Shaping materials, i.e. techniques for structuring the substrate or the layers on the substrate}
- 1/00444 . . {Surface micromachining, i.e. structuring layers on the substrate}
- 1/0046 . . . {using stamping, e.g. imprinting (nanoimprinting for making etch masks [G03F 7/0002](#))}
- 1/00468 . . . {Releasing structures}
- 1/00476 {removing a sacrificial layer ([B81C 1/00912](#) takes precedence)}
- 1/00484 {Processes for releasing structures not provided for in group [B81C 1/00476](#)}
- 1/00492 . . . {Processes for surface micromachining not provided for in groups [B81C 1/0046](#) - [B81C 1/00484](#)}
- 1/005 . . . {Bulk micromachining}
- 1/00507 . . . {Formation of buried layers by techniques other than deposition, e.g. by deep implantation of elements (SIMOX techniques [H01L 21/762](#))}
- 1/00515 . . . {Bulk micromachining techniques not provided for in [B81C 1/00507](#)}
- 1/00523 . . {Etching material}
- 1/00531 . . . {Dry etching}
- 1/00539 . . . {Wet etching}
- 1/00547 . . . {Etching processes not provided for in groups [B81C 1/00531](#) - [B81C 1/00539](#)}
- 1/00555 . . {Achieving a desired geometry, i.e. controlling etch rates, anisotropy or selectivity ([B81C 1/00023](#) - [B81C 1/0019](#) take precedence)}
- 1/00563 . . . {Avoid or control over-etching}
- 1/00571 {Avoid or control under-cutting}
- 1/00579 {Avoid charge built-up}
- 1/00587 {Processes for avoiding or controlling over-etching not provided for in [B81C 1/00571](#) - [B81C 1/00579](#)}
- 1/00595 . . . {Control etch selectivity}
- 1/00603 . . . {Aligning features and geometries on both sides of a substrate, e.g. when double side etching}
- 1/00611 . . . {Processes for the planarisation of structures (planarising depositions [C23C](#), [H01L](#))}
- 1/00619 . . . {Forming high aspect ratio structures having deep steep walls}
- 1/00626 . . . {Processes for achieving a desired geometry not provided for in groups [B81C 1/00563](#) - [B81C 1/00619](#)}
- 1/00634 . . {Processes for shaping materials not provided for in groups [B81C 1/00444](#) - [B81C 1/00626](#)}
- 1/00642 . {for improving the physical properties of a device}
- 1/0065 . . {Mechanical properties}
- 1/00658 . . . {Treatments for improving the stiffness of a vibrating element}
- 1/00666 . . . {Treatments for controlling internal stress or strain in MEMS structures}
- 1/00674 . . . {Treatments for improving wear resistance}
- 1/00682 . . . {Treatments for improving mechanical properties, not provided for in [B81C 1/00658](#) - [B81C 1/0065](#)}
- 1/0069 . . {Thermal properties, e.g. improve thermal insulation}

- 1/00698 . . {Electrical characteristics, e.g. by doping materials}
- 1/00706 . . {Magnetic properties}
- 1/00714 . . {Treatment for improving the physical properties not provided for in groups [B81C 1/0065](#) - [B81C 1/00706](#)}
- 1/00777 . {Preserve existing structures from alteration, e.g. temporary protection during manufacturing}
- 1/00785 . . {Avoid chemical alteration, e.g. contamination, oxidation or unwanted etching ([B81C 1/00563](#) - [B81C 1/00595](#) take precedence)}
- 1/00793 . . . {Avoid contamination, e.g. absorption of impurities or oxidation}
- 1/00801 . . . {Avoid alteration of functional structures by etching, e.g. using a passivation layer or an etch stop layer ([B81C 1/00595](#), [B81C 1/00468](#) take precedence)}
- 1/00809 . . . {Methods to avoid chemical alteration not provided for in groups [B81C 1/00793](#) - [B81C 1/00801](#)}
- 1/00817 . . {Avoid thermal destruction}
- 1/00825 . . {Protect against mechanical threats, e.g. against shocks, or residues ([B81C 1/00261](#) take precedence)}
- 1/00833 . . {Methods for preserving structures not provided for in groups [B81C 1/00785](#) - [B81C 1/00825](#)}
- 1/00841 . {Cleaning during or after manufacture ([cleaning of semiconductor devices H01L 21/306](#))}
- 1/00849 . . {during manufacture}
- 1/00857 . . {after manufacture, e.g. back-end of the line process}
- 1/00865 . {Multistep processes for the separation of wafers into individual elements}
- 1/00873 . . {characterised by special arrangements of the devices, allowing an easier separation}
- 1/0088 . . {Separation allowing recovery of the substrate or a part of the substrate, e.g. epitaxial lift-off}
- 1/00888 . . {Multistep processes involving only mechanical separation, e.g. grooving followed by cleaving}
- 1/00896 . . {Temporary protection during separation into individual elements}
- 1/00904 . . {Multistep processes for the separation of wafers into individual elements not provided for in groups [B81C 1/00873](#) - [B81C 1/00896](#)}
- 1/00912 . {Treatments or methods for avoiding stiction of flexible or moving parts of MEMS}
- 1/0092 . . {For avoiding stiction during the manufacturing process of the device, e.g. during wet etching}
- 1/00928 . . . {Eliminating or avoiding remaining moisture after the wet etch release of the movable structure}
- 1/00936 . . . {Releasing the movable structure without liquid etchant}
- 1/00944 . . . {Maintaining a critical distance between the structures to be released}
- 1/00952 . . . {Treatments or methods for avoiding stiction during the manufacturing process not provided for in groups [B81C 1/00928](#) - [B81C 1/00944](#)}
- 1/0096 . . {For avoiding stiction when the device is in use, i.e. after manufacture has been completed}
- 1/00968 . . . {Methods for breaking the stiction bond}
- 1/00976 . . . {Control methods for avoiding stiction, e.g. controlling the bias voltage}
- 1/00984 . . . {Methods for avoiding stiction when the device is in use not provided for in groups [B81C 1/00968](#) - [B81C 1/00976](#)}
- 1/00992 . . {Treatments or methods for avoiding stiction of flexible or moving parts of MEMS not provided for in groups [B81C 1/0092](#) - [B81C 1/00984](#)}
- 3/00 Assembling of devices or systems from individually processed components**
- 3/001 . {Bonding of two components}
- 3/002 . {Aligning microparts}
- 3/004 . . {Active alignment, i.e. moving the elements in response to the detected position of the elements using internal or external actuators}
- 3/005 . . {Passive alignment, i.e. without a detection of the position of the elements or using only structural arrangements or thermodynamic forces}
- 3/007 . . {Methods for aligning microparts not provided for in groups [B81C 3/004](#) - [B81C 3/005](#)}
- 3/008 . {Aspects related to assembling from individually processed components, not covered by groups [B81C 3/001](#) - [B81C 3/002](#)}
- 99/00 Subject matter not provided for in other groups of this subclass**
- 99/0005 . {Apparatus specially adapted for the manufacture or treatment of microstructural devices or systems, or methods for manufacturing the same}
- 99/001 . . {for cutting, cleaving or grinding}
- 99/0015 . . {for microextrusion ([extrusion heads in general B29C 47/12](#))}
- 99/002 . . {Apparatus for assembling MEMS, e.g. micromanipulators ([micromanipulators per se B25J 7/00](#))}
- 99/0025 . . {Apparatus specially adapted for the manufacture or treatment of microstructural devices or systems not provided for in [B81C 99/001](#) - [B81C 99/002](#)}
- 99/003 . {Characterising MEMS devices, e.g. measuring and identifying electrical or mechanical constants}
- 99/0035 . {Testing}
- 99/004 . . {during manufacturing}
- 99/0045 . . {End test of the packaged device}
- 99/005 . . {Test apparatus}
- 99/0055 . {Manufacturing logistics}
- 99/006 . . {Design; Simulation}
- 99/0065 . . {Process control; Yield prediction}
- 99/007 . . {Marking}
- 99/0075 . {Manufacture of substrate-free structures}
- 99/008 . . {separating the processed structure from a mother substrate}
- 99/0085 . . {using moulds and master templates, e.g. for hot-embossing}
- 99/009 . . {Manufacturing the stamps or the moulds}
- 99/0095 . . {Aspects relating to the manufacture of substrate-free structures, not covered by groups [B81C 99/008](#) - [B81C 99/009](#)}
- 2201/00 Manufacture or treatment of microstructural devices or systems**
- 2201/01 . in or on a substrate
- 2201/0101 . . Shaping material; Structuring the bulk substrate or layers on the substrate; Film patterning
- 2201/0102 . . . Surface micromachining
- 2201/0104 Chemical-mechanical polishing [CMP]
- 2201/0105 Sacrificial layer

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- 2201/0107 Sacrificial metal
- 2201/0108 Sacrificial polymer, ashing of organics
- 2201/0109 Sacrificial layers not provided for in [B81C 2201/0107](#) - [B81C 2201/0108](#)
- 2201/0111 . . . Bulk micromachining
- 2201/0112 Bosch process
- 2201/0114 Electrochemical etching, anodic oxidation
- 2201/0115 Porous silicon
- 2201/0116 Thermal treatment for structural rearrangement of substrate atoms, e.g. for making buried cavities
- 2201/0118 . . . Processes for the planarization of structures
- 2201/0119 involving only addition of materials, i.e. additive planarization
- 2201/0121 involving addition of material followed by removal of parts of said material, i.e. subtractive planarization
- 2201/0122 Selective addition
- 2201/0123 Selective removal
- 2201/0125 Blanket removal, e.g. polishing
- 2201/0126 Processes for the planarization of structures not provided for in [B81C 2201/0119](#) - [B81C 2201/0125](#)
- 2201/0128 . . . Processes for removing material
- 2201/0129 Diamond turning
- 2201/013 Etching
- 2201/0132 Dry etching, i.e. plasma etching, barrel etching, reactive ion etching [RIE], sputter etching or ion milling
- 2201/0133 Wet etching
- 2201/0135 Controlling etch progression
- 2201/0136 by doping limited material regions
- 2201/0138 Monitoring physical parameters in the etching chamber, e.g. pressure, temperature or gas composition
- 2201/0139 with the electric potential of an electrochemical etching
- 2201/014 by depositing an etch stop layer, e.g. silicon nitride, silicon oxide, metal
- 2201/0142 Processes for controlling etch progression not provided for in [B81C 2201/0136](#) - [B81C 2201/014](#)
- 2201/0143 Focussed beam, i.e. laser, ion or e-beam
- 2201/0145 Spark erosion
- 2201/0146 Processes for removing material not provided for in [B81C 2201/0129](#) - [B81C 2201/0145](#)
- 2201/0147 . . . Film patterning
- 2201/0149 Forming nanoscale microstructures using auto-arranging or self-assembling material
- 2201/015 Imprinting
- 2201/0152 Step and Flash imprinting, UV imprinting
- 2201/0153 Imprinting techniques not provided for in [B81C 2201/0152](#)
- 2201/0154 other processes for film patterning not provided for in [B81C 2201/0149](#) - [B81C 2201/015](#)
- 2201/0156 . . . Lithographic techniques
- 2201/0157 Gray-scale mask technology
- 2201/0159 Lithographic techniques not provided for in [B81C 2201/0157](#)
- 2201/016 . . . Passivation
- 2201/0161 . . Controlling physical properties of the material
- 2201/0163 . . . Controlling internal stress of deposited layers
- 2201/0164 by doping the layer
- 2201/0166 by ion implantation
- 2201/0167 by adding further layers of materials having complementary strains, i.e. compressive or tensile strain
- 2201/0169 by post-annealing
- 2201/017 Methods for controlling internal stress of deposited layers not provided for in [B81C 2201/0164](#) - [B81C 2201/0169](#)
- 2201/0171 . . . Doping materials
- 2201/0173 Thermo-migration of impurities from a solid, e.g. from a doped deposited layer
- 2201/0174 . . . for making multi-layered devices, film deposition or growing
- 2201/0176 . . . Chemical vapour Deposition
- 2201/0177 Epitaxy, i.e. homo-epitaxy, hetero-epitaxy, GaAs-epitaxy
- 2201/0178 Oxidation
- 2201/018 Plasma polymerization, i.e. monomer or polymer deposition
- 2201/0181 . . . Physical Vapour Deposition [PVD], i.e. evaporation, sputtering, ion plating or plasma assisted deposition, ion cluster beam technology
- 2201/0183 . . . Selective deposition
- 2201/0184 Digital lithography, e.g. using an inkjet print-head
- 2201/0185 Printing, e.g. microcontact printing
- 2201/0187 Controlled formation of micro- or nanostructures using a template positioned on a substrate
- 2201/0188 Selective deposition techniques not provided for in [B81C 2201/0184](#) - [B81C 2201/0187](#)
- 2201/019 . . . Bonding or gluing multiple substrate layers
- 2201/0191 . . . Transfer of a layer from a carrier wafer to a device wafer
- 2201/0192 by cleaving the carrier wafer
- 2201/0194 the layer being structured
- 2201/0195 the layer being unstructured
- 2201/0197 . . . Processes for making multi-layered devices not provided for in groups [B81C 2201/0176](#) - [B81C 2201/0192](#)
- 2201/0198 . . . for making a masking layer
- 2201/03 . . Processes for manufacturing substrate-free structures
- 2201/032 . . . LIGA process
- 2201/034 . . . Moulding
- 2201/036 . . . Hot embossing
- 2201/038 . . . Processes for manufacturing substrate-free structures not provided for in [B81C 2201/034](#) - [B81C 2201/036](#)
- 2201/05 . . Temporary protection of devices or parts of the devices during manufacturing
- 2201/053 . . Depositing a protective layers
- 2201/056 . . Releasing structures at the end of the manufacturing process
- 2201/11 . . Treatments for avoiding stiction of elastic or moving parts of MEMS
- 2201/112 . . Depositing an anti-stiction or passivation coating, e.g. on the elastic or moving parts
- 2201/115 . . Roughening a surface
- 2201/117 . . Using supercritical fluid, e.g. carbon dioxide, for removing sacrificial layers

2203/00 Forming microstructural systems

- 2203/01 . Packaging MEMS
- 2203/0109 . . Bonding an individual cap on the substrate
- 2203/0118 . . Bonding a wafer on the substrate, i.e. where the cap consists of another wafer
- 2203/0127 . . Using a carrier for applying a plurality of packaging lids to the system wafer
- 2203/0136 . . Growing or depositing of a covering layer
- 2203/0145 . . Hermetically sealing an opening in the lid
- 2203/0154 . . Moulding a cap over the MEMS device
- 2203/0163 . . Reinforcing a cap, e.g. with ribs
- 2203/0172 . . Seals
- 2203/0181 . . . Using microheaters for bonding the lid
- 2203/019 . . . characterised by the material or arrangement of seals between parts
- 2203/03 . Bonding two components
- 2203/031 . . Anodic bondings
- 2203/032 . . Gluing
- 2203/033 . . Thermal bonding
- 2203/035 . . . Soldering
- 2203/036 . . . Fusion bonding
- 2203/037 . . . Thermal bonding techniques not provided for in [B81C 2203/035](#) - [B81C 2203/036](#)
- 2203/038 . . Bonding techniques not provided for in [B81C 2203/031](#) - [B81C 2203/037](#)
- 2203/05 . Aligning components to be assembled
- 2203/051 . . Active alignment, e.g. using internal or external actuators, magnets, sensors, marks or marks detectors
- 2203/052 . . Passive alignment, i.e. using only structural arrangements or thermodynamic forces without an internal or external apparatus
- 2203/054 . . . using structural alignment aids, e.g. spacers, interposers, male/female parts, rods or balls
- 2203/055 . . . using the surface tension of fluid solder to align the elements
- 2203/057 . . . Passive alignment techniques not provided for in [B81C 2203/054](#) - [B81C 2203/055](#)
- 2203/058 . . Aligning components using methods not provided for in [B81C 2203/051](#) - [B81C 2203/052](#)
- 2203/07 . Integrating an electronic processing unit with a micromechanical structure
- 2203/0707 . . Monolithic integration, i.e. the electronic processing unit is formed on or in the same substrate as the micromechanical structure
- 2203/0714 . . . Forming the micromechanical structure with a CMOS process
- 2203/0721 . . . Forming the micromechanical structure with a low-temperature process ([B81C 2203/0735](#) takes precedence)
- 2203/0728 . . . Pre-CMOS, i.e. forming the micromechanical structure before the CMOS circuit
- 2203/0735 . . . Post-CMOS, i.e. forming the micromechanical structure after the CMOS circuit
- 2203/0742 . . . Interleave, i.e. simultaneously forming the micromechanical structure and the CMOS circuit
- 2203/075 . . . the electronic processing unit being integrated into an element of the micromechanical structure
- 2203/0757 . . . Topology for facilitating the monolithic integration
- 2203/0764 Forming the micromechanical structure in a groove

- 2203/0771 Stacking the electronic processing unit and the micromechanical structure
- 2203/0778 Topology for facilitating the monolithic integration not provided for in [B81C 2203/0764](#) - [B81C 2203/0771](#)
- 2203/0785 . . Transfer and join technology, i.e. forming the electronic processing unit and the micromechanical structure on separate substrates and joining the substrates
- 2203/0792 . . . Forming interconnections between the electronic processing unit and the micromechanical structure

2900/00 Apparatus specially adapted for the manufacture or treatment of microstructural devices or systems

- 2900/02 . Microextrusion heads