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**

1. 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.
2. 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.

<table>
<thead>
<tr>
<th>1/00</th>
<th>Manufacture or treatment of devices or systems in or on a substrate (B81C 3/00 takes precedence)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/0007</td>
<td>{Assembling automatically hinged components, i.e. self-assembly processes (self-assembly mechanisms B81B 7/0003)}</td>
</tr>
<tr>
<td>1/0015</td>
<td>{for manufacturing microsystems}</td>
</tr>
<tr>
<td>1/0023</td>
<td>{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. microrreactors B01J 19/0093, lab-on-chip B01L 3/5027, micromixers B01F 13/0059)}</td>
</tr>
<tr>
<td>1/0031</td>
<td>{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)}</td>
</tr>
<tr>
<td>1/0039</td>
<td>{Anchors}</td>
</tr>
<tr>
<td>1/0047</td>
<td>{Cavities}</td>
</tr>
<tr>
<td>1/0055</td>
<td>{Grooves}</td>
</tr>
<tr>
<td>1/0063</td>
<td>{Trenches}</td>
</tr>
<tr>
<td>1/0071</td>
<td>{Channels}</td>
</tr>
<tr>
<td>1/0079</td>
<td>{Grooves not provided for in groups B81C 1/00063 - B81C 1/00071}</td>
</tr>
<tr>
<td>1/0087</td>
<td>{Holes}</td>
</tr>
<tr>
<td>1/0095</td>
<td>{Interconnects}</td>
</tr>
<tr>
<td>1/0103</td>
<td>{Structures having a predefined profile, e.g. sloped or rounded grooves}</td>
</tr>
<tr>
<td>1/0111</td>
<td>{Tips, pillars, i.e. raised structures (microneedles A61M 37/0015)}</td>
</tr>
<tr>
<td>1/00119</td>
<td>{Arrangement of basic structures like cavities or channels, e.g. suitable for microfluidic systems}</td>
</tr>
<tr>
<td>1/00126</td>
<td>{Static structures not provided for in groups B81C 1/00031 - B81C 1/00119}</td>
</tr>
<tr>
<td>1/00134</td>
<td>{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)}</td>
</tr>
<tr>
<td>1/00142</td>
<td>{Bridges (deformable micromirrors G02B 26/0041)}</td>
</tr>
<tr>
<td>1/0015</td>
<td>{Cantilevers (switches using MEMS H01H 1/0036; electrostatic relays using micromechanics H01H 59/0009; micromechanical resonators H03H 9/02244)}</td>
</tr>
<tr>
<td>1/00158</td>
<td>{Diaphragms, membranes (manufacture process for semi-permeable inorganic membranes B01D 67/0039)}</td>
</tr>
<tr>
<td>1/00166</td>
<td>{Electrodes}</td>
</tr>
<tr>
<td>1/00174</td>
<td>{See-saws}</td>
</tr>
<tr>
<td>1/00182</td>
<td>{Arrangements of deformable or non-deformable structures, e.g. membrane and cavity for use in a transducer}</td>
</tr>
<tr>
<td>1/0019</td>
<td>{Flexible or deformable structures not provided for in groups B81C 1/00142 - B81C 1/00182}</td>
</tr>
<tr>
<td>1/00198</td>
<td>{comprising elements which are movable in relation to each other, e.g. comprising slidable or rotatable elements}</td>
</tr>
<tr>
<td>1/00206</td>
<td>{Processes for functionalising a surface, e.g. provide the surface with specific mechanical, chemical or biological properties}</td>
</tr>
</tbody>
</table>
I/00214 . . [Processes for the simultaneous manufacturing
of a network or an array of similar microstructural
device]
I/00222 . . [Integrating an electronic processing unit with a
micromechanical structure]
I/0023 . . . . [Packaging together an electronic processing
unit die and a micromechanical structure
die (MEMS packages B81B 7/0032; MEMS
packaging processes B81C 1/00261)]
I/00238 . . . . [Joining a substrate with an electronic
processing unit and a substrate with a
micromechanical structure]
I/00246 . . . . [Monolithic integration, i.e. micromechanical
structure and electronic processing unit are
integrated on the same substrate]
I/00253 . . . . [Processes for integrating an electronic
processing unit with a micromechanical
structure not provided for in
B81C 1/0023 - B81C 1/00246]
I/00261 . . . . [Processes for packaging MEMS devices (MEMS
packages B81B 7/0032; packaging of smart-
MEMS B81C 1/0023)]
I/00269 . . . . [Bonding of solid lids or wafers to the
substrate]
I/00277 . . . . [for maintaining a controlled atmosphere inside
of the cavity containing the MEMS]
I/00285 . . . . [using materials for controlling the level of
pressure, contaminants or moisture inside of the
package, e.g. getters]
I/00293 . . . . [maintaining a controlled atmosphere with
processes not provided for in B81C 1/00285]
I/00301 . . . . [Connecting electric signal lines from the
MEMS device with external electrical signal
lines, e.g. through vias]
I/00309 . . . . [suitable for fluid transfer from the MEMS out
of the package or vice versa, e.g. transfer of
liquid, gas, sound]
I/00317 . . . . [Packaging optical devices]
I/00325 . . . . [for reducing stress inside of the package
structure]
I/00333 . . . . [Aspects relating to packaging of
MEMS devices, not covered by groups
B81C 1/00269 - B81C 1/00325]
I/00341 . . . . [Processes for manufacturing
microsystems not provided for in groups
B81C 1/00023 - B81C 1/00261]
I/00349 . . . . [Creating layers of material on a substrate]
I/00357 . . . . [involving bonding one or several substrates on a
non-temporary support, e.g. another substrate]
I/00365 . . . . [having low tensile stress between layers]
I/00373 . . . . [Selective deposition, e.g. printing or
microcontact printing]
I/0038 . . . . . [Processes for creating layers of
materials not provided for in groups
B81C 1/00357 - B81C 1/00373]
I/00388 . . . . [Etch mask forming]
I/00396 . . . . [Mask characterised by its composition, e.g.
multilayer masks]
I/00404 . . . . [Mask characterised by its size, orientation or
shape]
I/00412 . . . . [Mask characterised by its behaviour during the
etching process, e.g. soluble masks]
I/0042 . . . . [Compensation masks in orientation dependent
etching]
I/00428 . . . . [Etch mask forming processes not provided for in
groups B81C 1/00396 - B81C 1/0042]
I/00436 . . . . [Shaping materials, i.e. techniques for structuring
the substrate or the layers on the substrate]
I/00444 . . . . [Surface micromachining, i.e. structuring layers
on the substrate]
I/0046 . . . . . [using stamping, e.g. imprinting
(nanoimprinting for making etch masks
G03F 7/0002)]
I/00468 . . . . [Relieving structures]
I/00476 . . . . . [removing a sacrificial layer (B81C 1/00912
takes precedence)]
I/00484 . . . . . [Processes for releasing structures not
provided for in group B81C 1/00476]
I/00492 . . . . . [Processes for surface micromachining
not provided for in groups
B81C 1/0046 - B81C 1/00484]
I/005 . . . . . [Bulk micromachining]
I/00507 . . . . . [Formation of buried layers by techniques
other than deposition, e.g. by deep
implantation of elements (SIMOX techniques
H01L 21/762)]
I/00515 . . . . . [Bulk micromachining techniques not provided
for in B81C 1/00507]
I/00523 . . . . . [Etching material]
I/00531 . . . . . [Dry etching]
I/00539 . . . . . [Wet etching]
I/00547 . . . . . [Etching processes not provided for in groups
B81C 1/00531 - B81C 1/00539]
I/00555 . . . . . [Achieving a desired geometry, i.e.
controlling etch rates, anisotropy or selectivity
(B81C 1/00023 - B81C 1/0019 take precedence)]
I/00563 . . . . . [Avoid or control over-etching]
I/00571 . . . . . [Avoid or control under-cutting]
I/00579 . . . . . [Avoid charge built-up]
I/00587 . . . . . [Processes for avoiding or controlling
over-etching not provided for in
B81C 1/00571 - B81C 1/00579]
I/00595 . . . . . [Control etch selectivity]
I/00603 . . . . . [Aligning features and geometries on both
sides of a substrate, e.g. when double side
etching]
I/00611 . . . . . [Processes for the planarisation of structures
(planarising depositions C23C, H01L)]
I/00619 . . . . . [Forming high aspect ratio structures having
deep steep walls]
I/00626 . . . . . [Processes for achieving a desired
geometry not provided for in groups
B81C 1/00563 - B81C 1/00619]
I/00634 . . . . . [Processes for shaping materials not provided for
in groups B81C 1/00444 - B81C 1/00626]
I/00642 . . . . . [for improving the physical properties of a device]
I/0065 . . . . . . [Mechanical properties]
I/00658 . . . . . [Treatments for improving the stiffness of a
vibrating element]
I/00666 . . . . . [Treatments for controlling internal stress or
strain in MEMS structures]
I/00674 . . . . . [Treatments for improving wear resistance]
I/00682 . . . . . [Treatments for improving mechanical
properties, not provided for in
B81C 1/00658 - B81C 1/0065]
I/0069 . . . . . [Thermal properties, e.g. improve thermal
insulation]
[...]

Methods for avoiding stiction when the device is in use not provided for in groups B81C 1/00968 - B81C 1/00976

[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 48/30)]
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

CPC - 2019.08
Controlling physical properties of the material

Lithographic techniques

Processes for removing material

Processes for the planarization of structures

Bulk micromachining

Processes for the planarization of structures not provided for in

B81C 2201/0157

Gray-scale mask technology

patterning not provided for in other processes for film

- B81C 2201/015

Imprinting

auto-arranging or self-assembling material

Forming nanoscale microstructures using for in B81C 2201/0129

- B81C 2201/0145

Focussed beam, i.e. laser, ion or e-beam

Etching

Diamond turning

Processes for the planarization of structures not provided for in

B81C 2201/0119 - B81C 2201/0125

Processes for removing material

Diamond turning

Etching

Dry etching, i.e. plasma etching, barrel etching, reactive ion etching [RIE], sputter etching or ion milling

Wet etching

Controlling etch progression

by doping limited material regions

Monitoring physical parameters in the etching chamber, e.g. pressure, temperature or gas composition with the electric potential of an electrochemical etching by depositing an etch stop layer, e.g. silicon nitride, silicon oxide, metal

Processes for controlling etch progression not provided for in

B81C 2201/0136 - B81C 2201/014

Focused beam, i.e. laser, ion or e-beam

Spark erosion

Processes for removing material not provided for in

B81C 2201/0129 - B81C 2201/0145

Film patterning

Forming nanoscale microstructures using auto-arranging or self-assembling material

Imprinting

Step and Flash imprinting, UV imprinting

Imprinting techniques not provided for in

B81C 2201/0152

other processes for film patterning not provided for in

B81C 2201/0149 - B81C 2201/015

Lithographic techniques

Gray-scale mask technology

Lithographic techniques not provided for in

B81C 2201/0157

Passivation

Controlling physical properties of the material

Controlling internal stress of deposited layers

by doping the layer

by ion implantation

by adding further layers of materials having

complementary strains, i.e. compressive or tensile strain

by post-annealing

Methods for controlling internal stress of deposited layers not provided for in

B81C 2201/0164 - B81C 2201/0169

Doping materials

Thermo-migration of impurities from a solid, e.g. from a doped deposited layer

for making multi-layered devices, film deposition or growing

Chemical vapour Deposition

Epitaxy, i.e. homo-epitaxy, hetero-epitaxy, GaAs-epitaxy

Oxidation

Physical Vapour Deposition [PVD], i.e. evaporation, sputtering, ion plating or plasma assisted deposition, ion cluster beam technology

Selective deposition

Digital lithography, e.g. using an inkjet print-head

Printing, e.g. microcontact printing

Controlled formation of micro- or nanostructures using a template positioned on a substrate

Selective deposition techniques not provided for in

B81C 2201/0184 - B81C 2201/0187

Bonding or gluing multiple substrate layers

Transfer of a layer from a carrier wafer to a device wafer

by cleaving the carrier wafer

the layer being structured

the layer being unstructured

Processes for making multi-layered devices not provided for in groups

B81C 2201/0176 - B81C 2201/0192

for making a masking layer

Processes for manufacturing substrate-free structures

LIGA process

Moulding

Hot embossing

Processes for manufacturing substrate-free structures not provided for in

B81C 2201/034 - B81C 2201/036

Temporary protection of devices or parts of the devices during manufacturing

Depositing a protective layers

Releasing structures at the end of the manufacturing process

Treatments for avoiding stiction of elastic or moving parts of MEMS

Depositing an anti-stiction or passivation coating, e.g. on the elastic or moving parts

Roughening a surface

Using supercritical fluid, e.g. carbon dioxide, for removing sacrificial layers
Forming microstructural systems

Bonding an individual cap on the substrate
Bonding a wafer on the substrate, i.e. where the cap consists of another wafer
Using a carrier for applying a plurality of packaging lids to the system wafer
Growing or depositing of a covering layer
Hermetically sealing an opening in the lid
Moulding a cap over the MEMS device
Reinforcing a cap, e.g. with ribs
Seals
Using microheaters for bonding the lid
characterised by the material or arrangement of seals between parts

Bonding two components
Anodic bondings
Gluing
Thermal bonding
Soldering
Fusion bonding
 Thermal bonding techniques not provided for in B81C 2203/035 - B81C 2203/036
Bonding techniques not provided for in B81C 2203/031 - B81C 2203/037
Aligning components to be assembled
Active alignment, e.g. using internal or external actuators, magnets, sensors, marks or marks detectors
Passive alignment, i.e. using only structural arrangements or thermodynamic forces without an internal or external apparatus
using structural alignment aids, e.g. spacers, interposers, male/female parts, rods or balls
using the surface tension of fluid solder to align the elements
Passive alignment techniques not provided for in B81C 2203/054 - B81C 2203/055
Aligning components using methods not provided for in B81C 2203/051 - B81C 2203/052
Integrating an electronic processing unit with a micromechanical structure
Monolithic integration, i.e. the electronic processing unit is formed on or in the same substrate as the micromechanical structure
Forming the micromechanical structure with a CMOS process
Forming the micromechanical structure with a low-temperature process (B81C 2203/0735 takes precedence)
Pre-CMOS, i.e. forming the micromechanical structure before the CMOS circuit
Post-CMOS, i.e. forming the micromechanical structure after the CMOS circuit
Interleave, i.e. simultaneously forming the micromechanical structure and the CMOS circuit
the electronic processing unit being integrated into an element of the micromechanical structure
Topology for facilitating the monolithic integration
Forming interconnections between the electronic processing unit and the micromechanical structure

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

Apparatus specially adapted for the manufacture or treatment of microstructural devices or systems
Microextrusion heads