Microfluid chip mass production technology

Point 1
Mass production of high quality, ultra-precision products with original manufacturing process
LIM (liquid injection molding) technology that employs high transparency PDMS and special mold technology enable the mass production of high quality, high precision products, such as micro-flow channels.
A ten cavity mold enables a production of 100,000 units per month.

<table>
<thead>
<tr>
<th>Material</th>
<th>Newly developed PDMS A60°C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transparency</td>
<td>Transparency 94% at 405nm wavelength</td>
</tr>
<tr>
<td>Molding method</td>
<td>Injection molding</td>
</tr>
</tbody>
</table>

Point 2
Mirror finish
Flow channels can achieve Ra50nm level surface roughness, reducing light source diffuse reflection.

Point 3
Free form design
Now we can propose solutions that meet our customers’ needs by producing the forms that our customers really wanted, but were not available with conventional casting methods.
Example:
1) Flow channel and hole formed in a single piece => No drilling required.
2) Tube connection formed in a single piece => To connect, simply insert the tube.

Point 4
Free design of groove depth
Flow channel groove depth can be freely designed.

Point 5
Minimum thickness of 0.4mm supported
Thin construction with total thickness 0.4mm can be supported without sacrificing material transparency.

Point 6
Complete bonding of flow channel and flat plates
Our original bonding technology enables complete bonding of PDMS components. Can be safely used where pressure resistance is required.
*Complete bonding to glass plate is also possible where required.

Microfluid chip form variations

<table>
<thead>
<tr>
<th>Basic form</th>
<th>Channel form</th>
<th>Channel depth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flat type (with holes)</td>
<td>The number and forms of flow channels can be designed as desired. E.g. Y or X shaped channels</td>
<td>Channel depth can be designed as desired (channels can also be stepped)</td>
</tr>
<tr>
<td>Tube connection integrated type</td>
<td></td>
<td></td>
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<tr>
<td>Seal integrated type</td>
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</table>
PDMS flow channel mass production… Really?

We have developed mass production technology for micro orders of micro-machined products.

**Point 1**

<table>
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<tr>
<th>Conventional processing</th>
<th>New technology</th>
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<tr>
<td>Several hundred units/ production lot</td>
<td>Production capacity 100,000/month</td>
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With conventional casting technology, processing takes considerable time. Where dimensions in tens of microns are called for in products, the limit is several hundred units per production lot.

Using our new technology, with 40 cavities in a mold, a production output of 100,000 units per month is possible.

**Point 2**

<table>
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<th>Conventional processing</th>
<th>New technology</th>
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<tr>
<td>QCD challenges presented by post-processing of flow channels</td>
<td>QCD challenges resolved</td>
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</table>

When flow channels are produced by casting and insertion inlets, etc., need to be post-processed, in the case of high precision products, post-processing presents challenges in terms of QCD*. *QCD = Quality, Cost, Delivery

Our new technology enables customized production of flow channels of various shapes, for example with “insertion inlet”.

**New Technology**

With the development of this new technology, we can now use precision mold forming technology and special mold technology to deliver mass production of micro orders of micro-machined products.

The new technology uses injection mold forming, so it is able to accommodate many different variations in shape design, and enables insertion inlets to be part of the shape. Generally speaking, with 40 cavities in one mold, a production capacity of 100,000 units per month can be achieved.

In order to confirm the quality of micro-machined products, product shape analysis can be carried out using a laser microscope.
1. Material: Highly transparent PDMS (polydimethylsiloxane) with 94% light transmittance (405 nm wavelength).
3. Channel: 1 μm to 100 μm or less in depth and 1 μm or greater in width.
4. Molding tool: Prepared by machining or photolithography.
5. Bonding: The channel layer and the cover layer are firmly bonded together after plasma surface treatment.
6. Specularity: Surface roughness of Ra 50nm or less.
7. Shape: Possible to insert a tube to ease the injection of liquids into the channels. Can accommodate variety of your requirements.
8. Thickness: 0.4mm at minimum, in total of the channel layer and the cover layer.
9. Prototype: Can produce 200 or more prototypes in stable shapes from one wafer by transfer molding on a resist etched silicon wafer.
10. Bonding technology: Can bond PDMS with various materials under atmospheric pressure without using a primer; PDMS to PDMS, glass, metal (Stainless steel, Copper, etc.), or plastic (COP, PS).

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1. Can mass produce highly transparent, molded micro-channeled PDMS chips.
2. Can provide prototypes from 1 to 1,000 pieces by utilizing a resist etched silicon wafer.
3. Excellent in transparency and specularity. Can bond PDMS with various materials such as glasses, metals, plastics, etc., in addition to PDMS to PDMS bonding.