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Microfluidics 6: PDMS Chip, Optical Quality Control and Flow Leakage Test

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ABSTRACT

Fabrication of microfluidic chips requires high quality and high resolution manufacturing techniques. After fabrication, the quality inspection is crucial and can be performed optically for visual parameters and flow application. If the sizes are well, chips are clean and intake, and flow is laminar without leakage, then everything is OK. This protocol describes the methods for testing of the chips fabricated in our laboratory.

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KEYWORDS

microfluidics, PDMS, quality control, flow rate testing, leakage testing

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MATERIALS TEXT

Syringe, 1mL
Distilled water, non-sterile filtered
Food coloring, minute amount
Tubings, silicone OD:2.5mm, ID:1.5mm
Fitting parts, 3D printed

BEFORE STARTING

Chip Quality Control 25m

10m

- 1 Optical Quality Control of the microfluidic chips are performed by using digital microscope. The visual parameters checked for acceptance of the chip are as listed below.

- Defects and scratches
- Strains and voids
- Dirt in features
- Air bubbles in features
- Ports and Bonding, out of alignment
- Not bond features
- Incorrect sizes of features
- Broken PDMS and/or glass
- Uneven PDMS thickness

All the parameters are controlled under 4X digital microscope and any abnormalities are reported as photo recordings.

Digital Microscope
Andonstar 4X ADSM201

Microchannel Quality Control 25m

25m

- 2 The microchannels inside PDMS chips after bonding are needed to be checked for the parameters which are

- Defects and scratches, micron size
- Strains and voids, micron size
- Dirts inside microchannels
- Airbubbles inside microchannels
- Multiple channel layers, out of on top alignment
- Not bond microchannels
- Incorrect sizes of microchanel and microfeatures

The microchannel quality control is performed using a high quality microscope and CCD camera. The sizes of micron features are measured using software of the CCD camera.

Epi-Fluorescent Microscope
Zeiss AxioObserver

Leakage Flow Tests 25m

- 3 The chip setup is formed by the components given as

- Syringe pump and 1mL syringe
- Tubings and Fittings suitable for 2mm ports
- Microfluidic chip to be testes

The substeps to follow the leakage test are

- 3.1 Fill the syringes with 1mL of distilled water.
Distilled water and isopropanol are two most used chemical for all tests performed in microfluidics.
The distilled water does not have to be sterilized but it is better to filter the liquid sample.
- 3.2 Connect the proper fittings on syringe to connect tubing and port of the chips. The proper fittings are chosen from
<https://www.ufluidic.com/collections/fittings-and-connectors>
- Mostly, single port is enough to fill all channels of the chip but when multiple ports to be used for filling all channels, distilled water mixed with food coloring is used. Food coloring is also beneficial for detection of the possible leakage points.



Food coloring is useless for very small size channels that is smaller than 25 microns.

Syringe pump

Chemyx Fusion 100

- 3.3 The flow rate arranged are increased step by step starting from 0,1 uL/min. The increases step values are x10 and given as below. When the leakage occurs, the flow rate is recorded. Under normal conditions, leakage must occur higher than 2 mL/min, but chip design and channel resistance effects the minimum flow rate of leakage starts.
- 0,1 uL/min
 - 1,0 uL/min
 - 10 uL/min
 - 100 uL/min
 - 1mL/min (1000 uL/min)