A New Fabrication Process of Ultrathick Microfluidic Microstructures Utilizing SU-8 Photoresist

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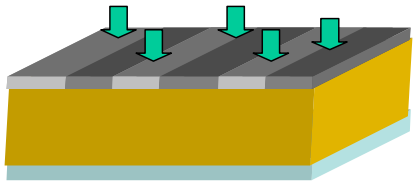
Fabrication Techniques

- Constant volume injection
  - No edge-bead effect
  - Good uniformity
  - Good flatness
  - Less photoresist wastage
- Higher SB and lower PEB temperature
  - Shorter processing time
  - Better structure definition
- A new mask design concept
  - Smaller exposed area
  - Discrete exposed area
- UV glue and SU-8 Bonding technique

Fabrication processes

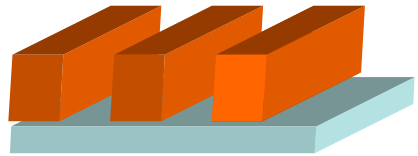
Substrate cleaning

Constant volume injection of SU-8

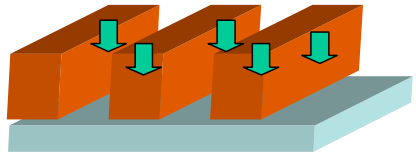


Softbake at 120 °C and exposure

Post exposure bake at 65 °C

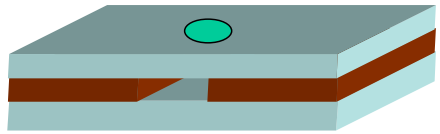


PGMEA developing



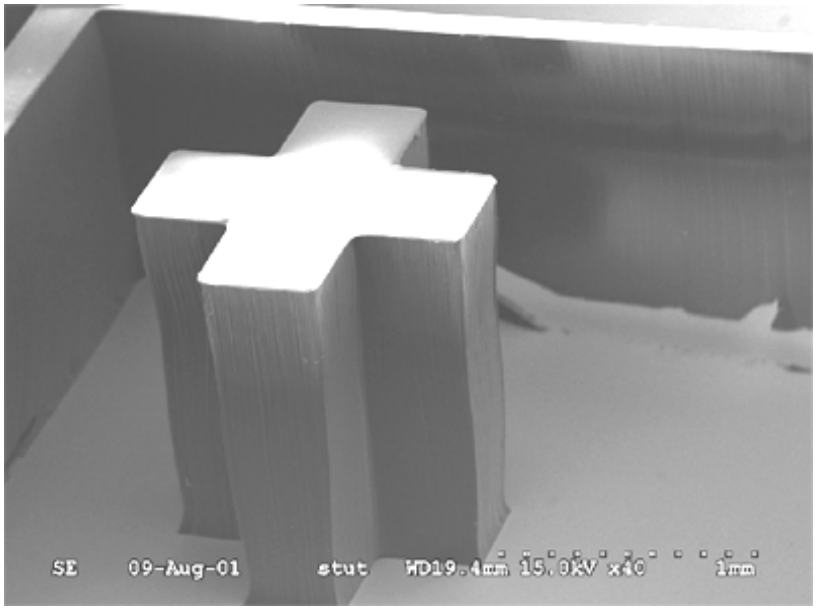
2nd flood exposure

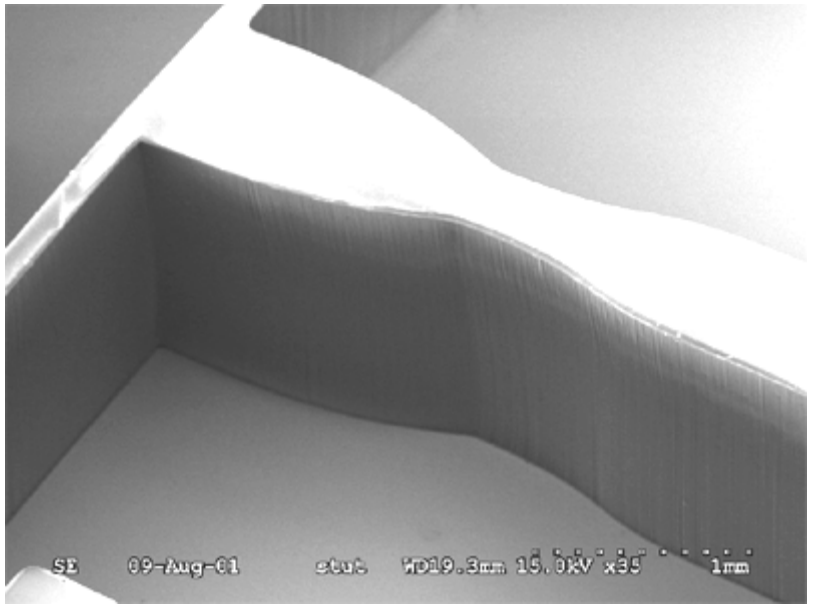
Structure release and hardbake



UV glue bonding

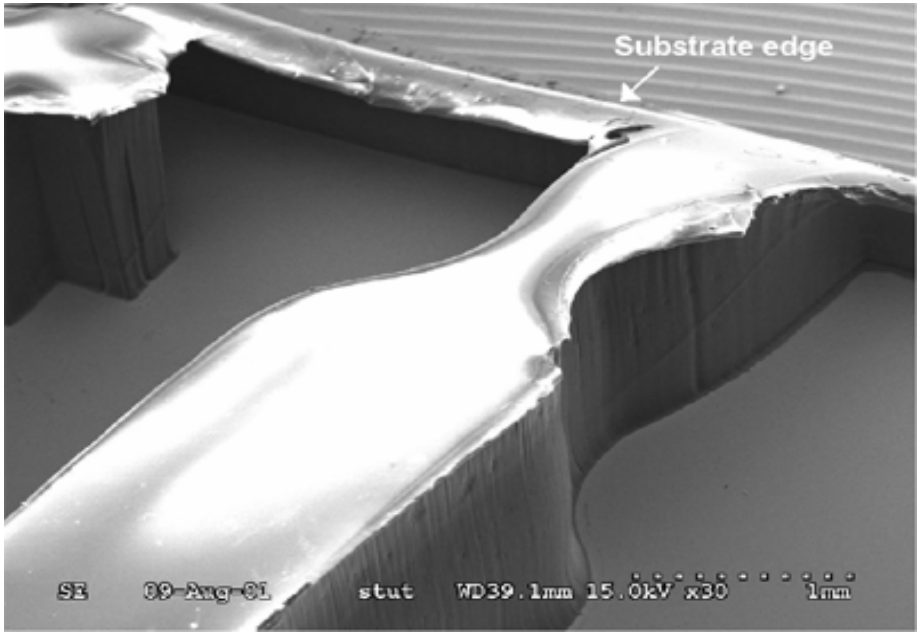
Ultrathick SU-8 structures



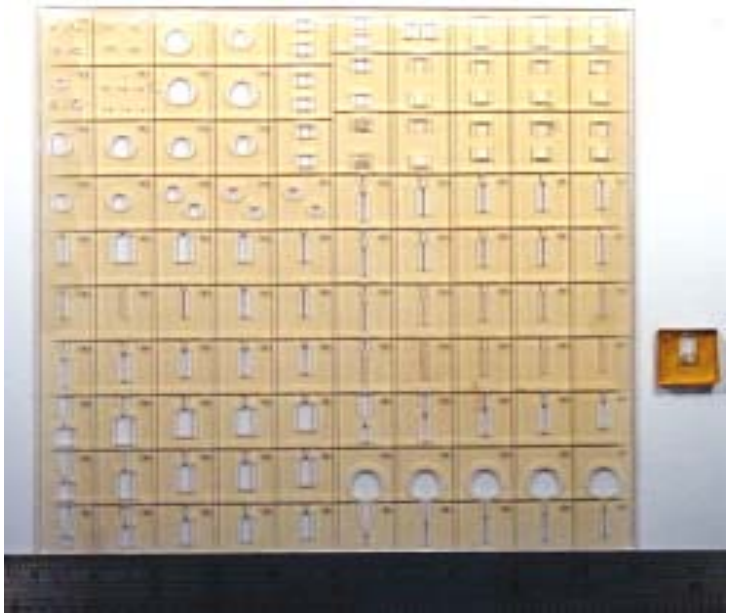


- Structure thickness: 1.5 mm
- Nearly vertical sidewall
- Good shape definition
- Minimum feature width: 100 μm
- Aspect ratio > 15

Thickness profile at the edge and photoresist uniformity

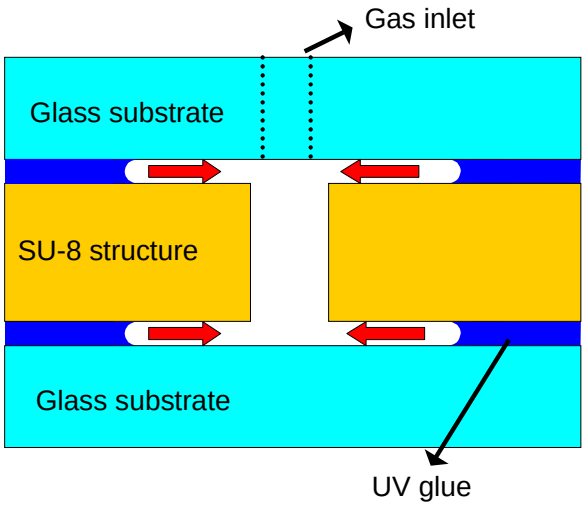


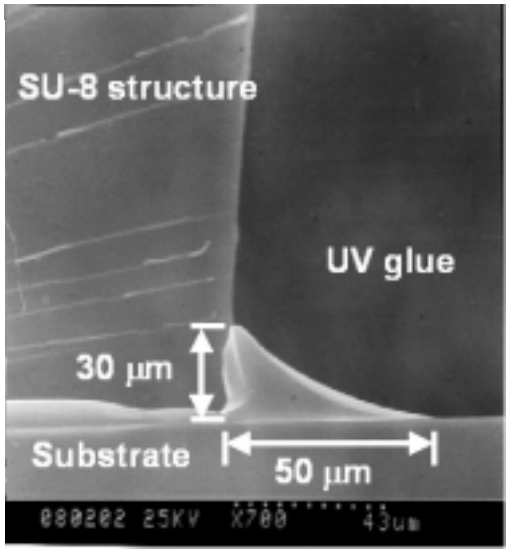
- No edge bead
- Reaching setting thickness within 3 mm

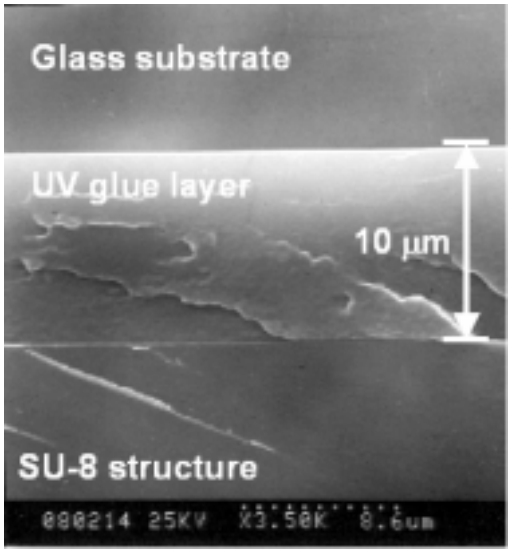


- Substrate size: 10 x 10 cm^2
- Variation: ~ 3.1%

UV glue bonding Technique

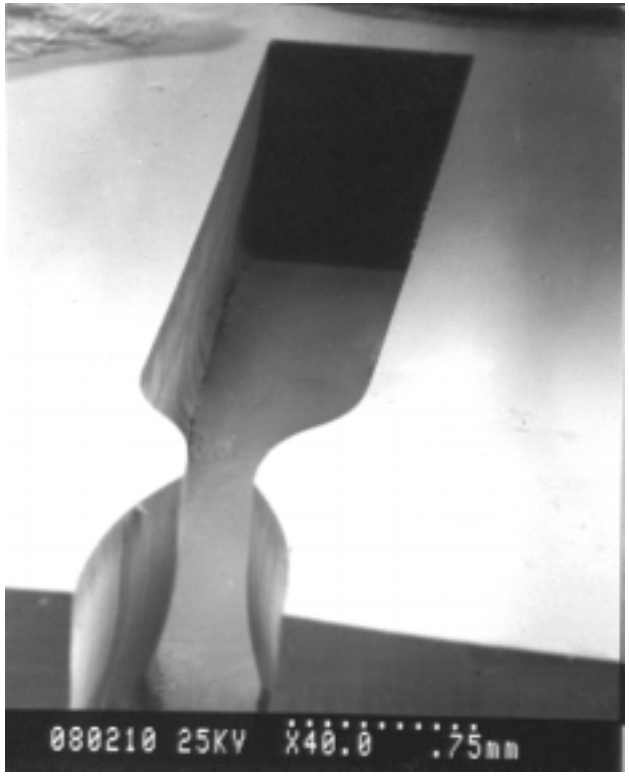






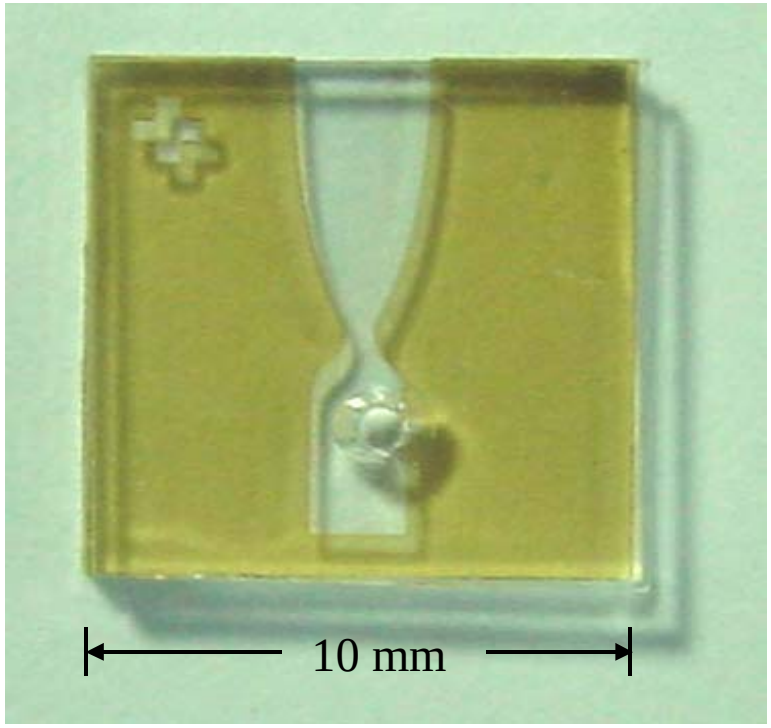
- Driven by capillary force
- Stopped by surface tension of UV glue
- Observation is not required
- High bonding strength can be obtained

SU-8 micronozzles



Structure height: ~ 1 mm

Width of nozzle: 250 μm

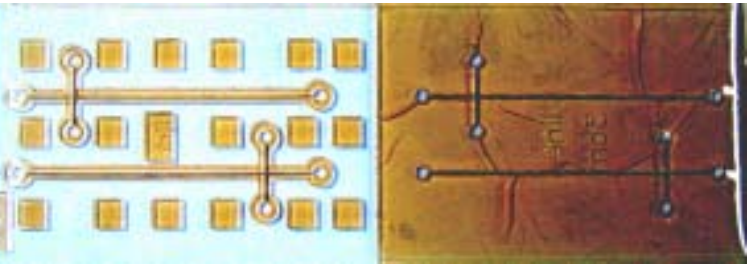


Size: 1 cm X 1 cm

Gas inlet via hole: 700 μm

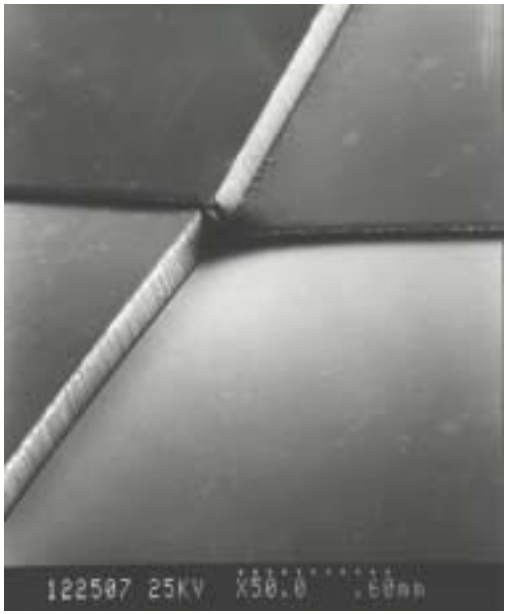
A new pattern design concept

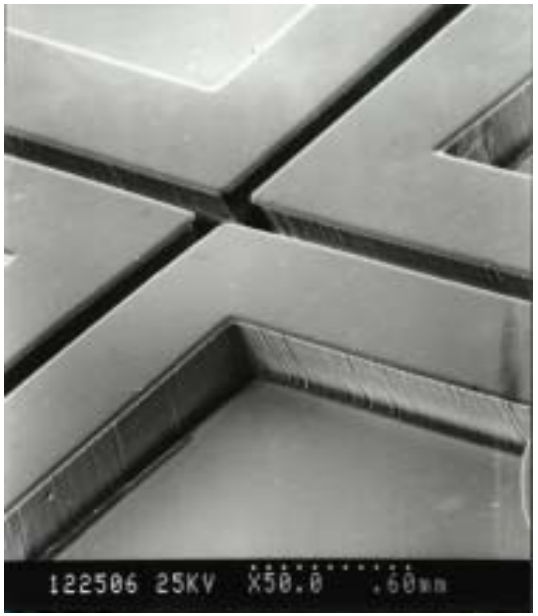
Micro channel: height 1 mm, width: 100 μm



New design concept Conventional design

- Reduce exposed area.
- Separate exposed region.





Conventional design New design concept

- Channel collapsed with conventional design.
- Well-defined channel obtained with new design concept.

Summaries

- A fast, low cost process was developed for fabrication of microfluidic devices.
- SU-8 PR layer thicker than1.5 mm could be formed by single coating.
- An easy, high strength bonding technique was used for sealing microchannels.
- A modified baking process was developed to get a better shape definition.
- A new mask design concept was proposed for fabrication of ultra-deep trenches.