

Local Environmental Control

by World-to-Chip Interface Microchip and Pipette



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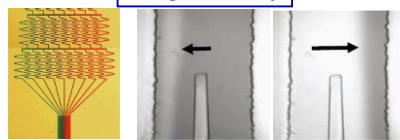


How to control local environment more arbitrarily and dynamically?

Background

Conventional Local Environmental Control

using microchip

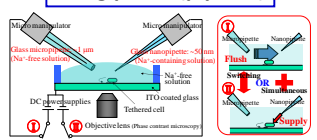


G. M. Whitesides et al., 2001

✓ Gradient
✗ Undynamic

✓ Dynamic
✗ Low facultivity

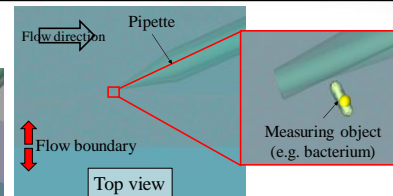
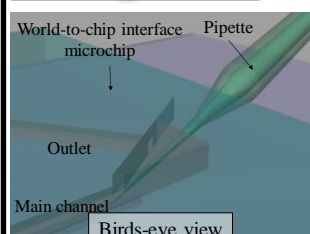
using probe (pipette)



K. Nogawa et al., 2011

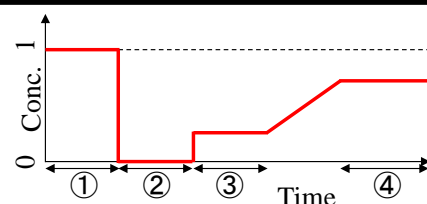
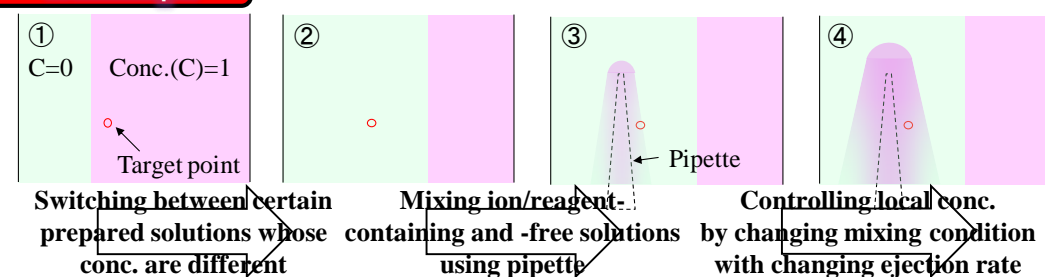
✓ Dynamic & arbitrary
✗ limited flushing performance

Purpose



To control local environment more arbitrarily and dynamically by combining WtCI microchip and pipette

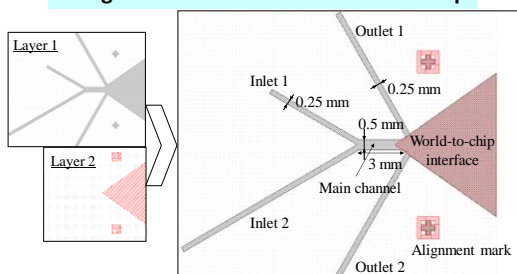
Concept



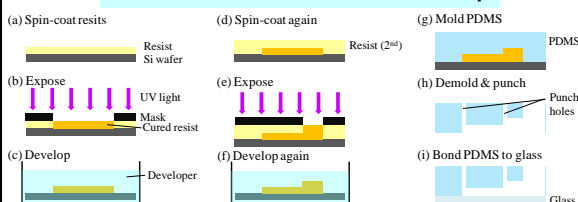
Rate of change of concentration also can be controlled by adjusting the rate of change of ejection rate.

Materials & Methods

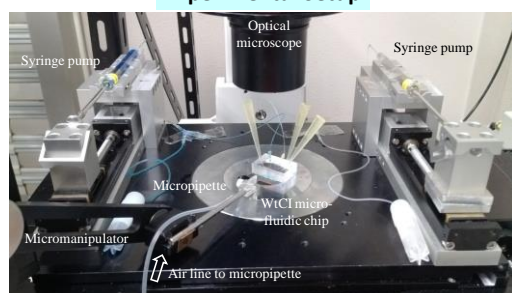
Design and Dimension of WtCI Microchip



Fabrication Process of WtCI Microchip

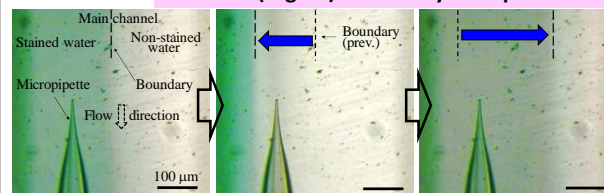


Experimental Setup



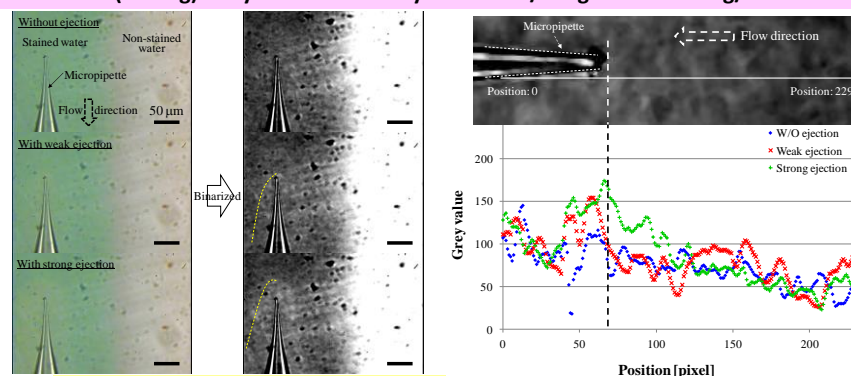
Experimental Results

Discrete (Digital) Control by Manipulation of Flow Boundary



Ion/Reagent concentration at a certain local target point was **controlled discretely** by flow boundary manipulation.

Indiscrete (Analog) & Dynamic Control by Mix of Ion/Reagent-containing/-free Solutions



Ion/Reagent concentration at a certain local target point was **changed** depending on the ejection rate and the position relative to the micropipette.

Conclusions

- Developed the local environmental control system with WtCI microchip and pipette
- Demonstrated discrete (digital) control by manipulation of flow boundary
- Demonstrated indiscrete (analog) and dynamic control by the mix of stain-containing/-free solutions