

***Continuous Flow Chemical Processing on
a Microchip Using Microunit Operations
and a Multiphase Flow Network***

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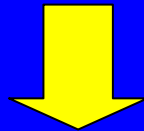
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4. Summary

How to realize “Chemical Processing” on a Chip ?

Micro unit operations (MUO)

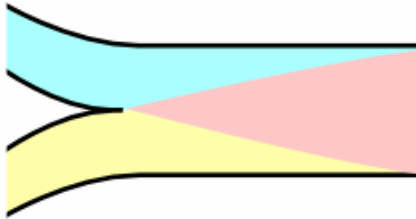
Multiphase flow network



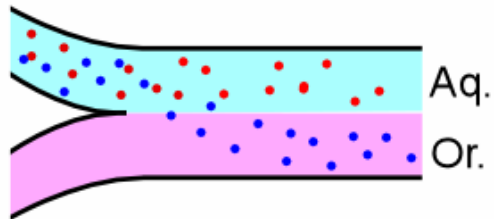
Continuous Flow Chemical Processing (CFCP)

Micro Unit Operation (MUO)

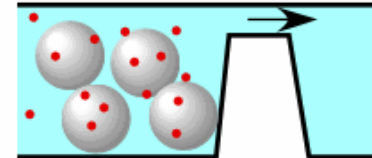
Mixing & Reaction



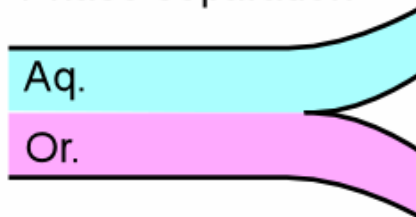
Molecular transport
Solvent extraction



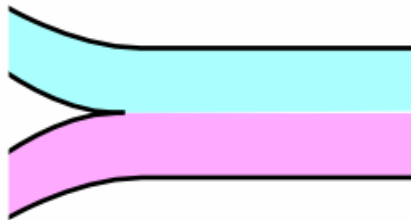
Molecular capture
Solid extraction



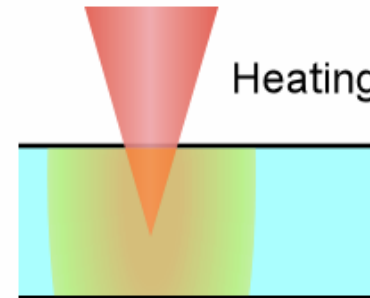
Phase separation



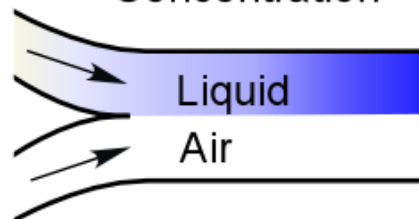
Phase confluence



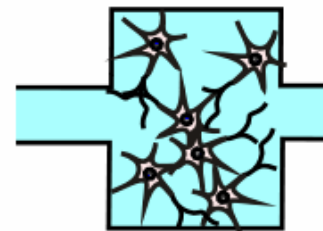
Heating



Concentration

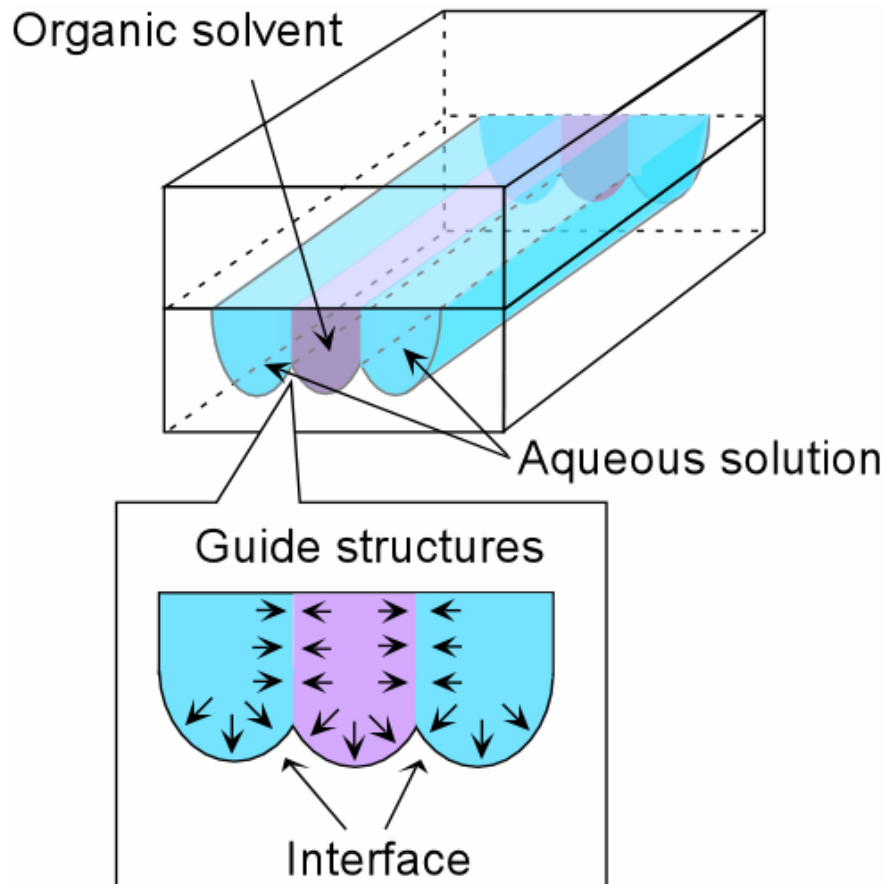


Cell culture

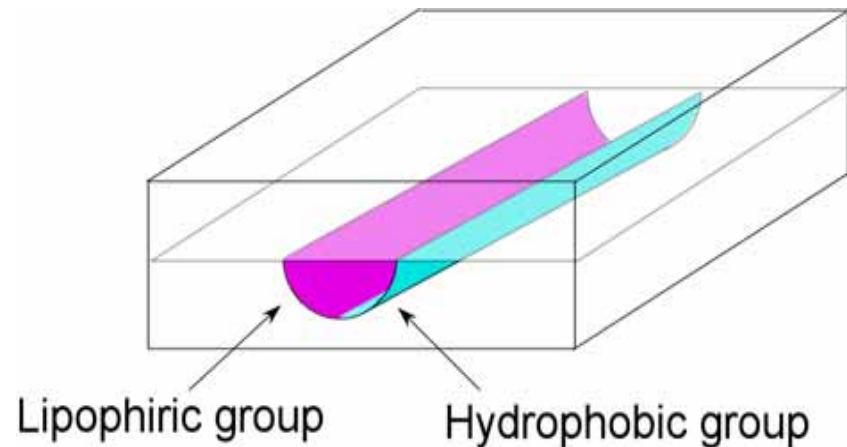


Stabilization of Multiphase Flow Network Inside Microchannels

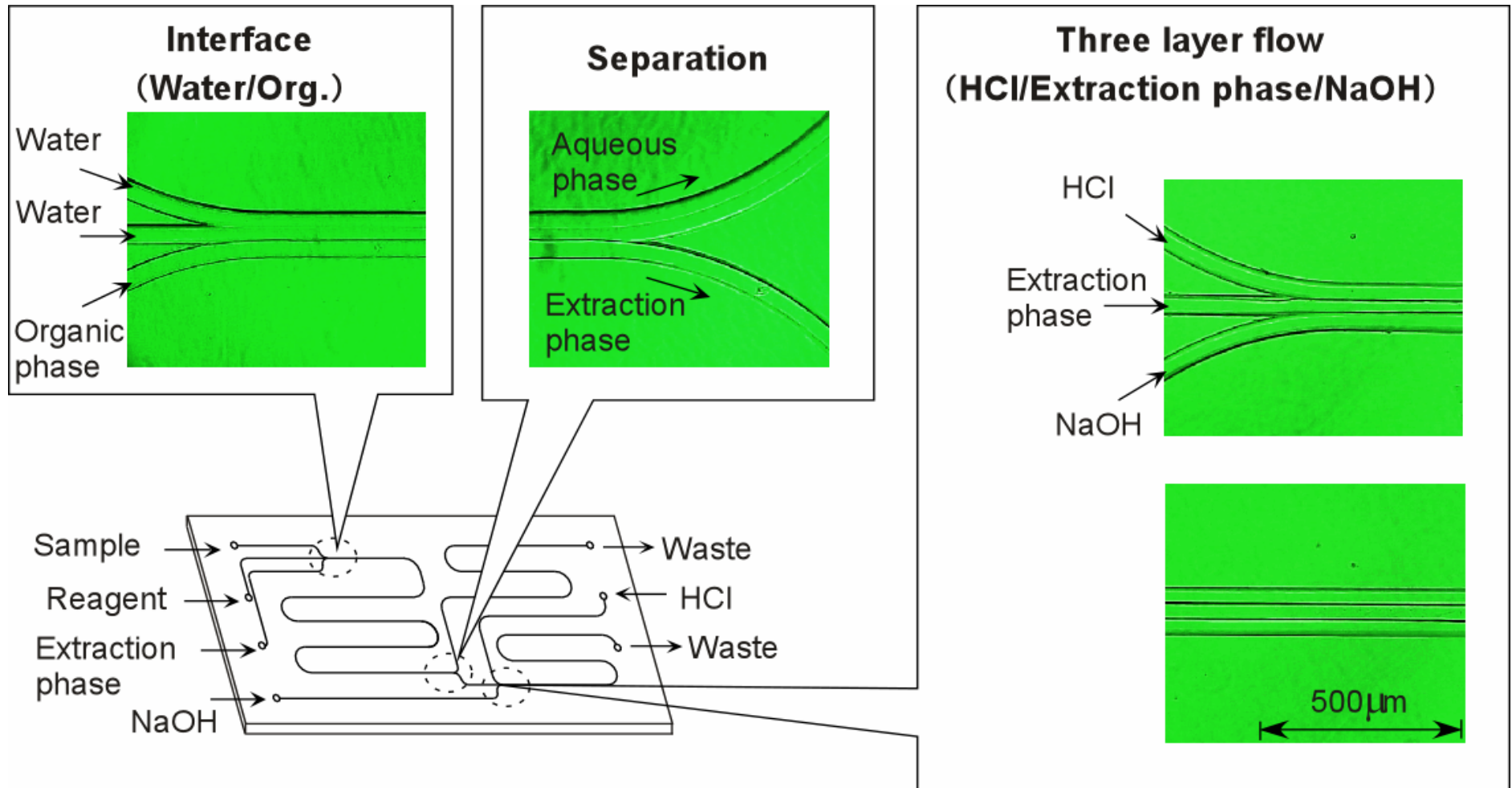
Guide structures



Surface modification



Multiphase Flow Network

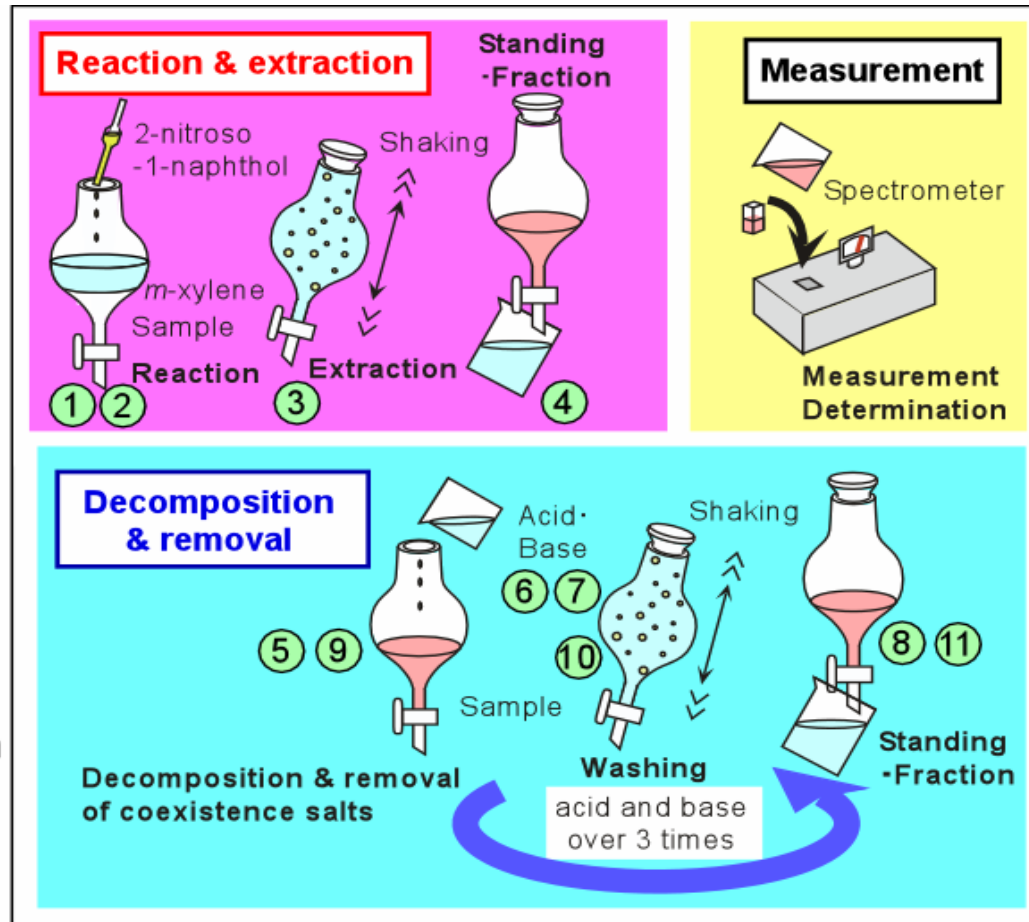


Example of Co wet analysis using CFCP



Procedures of Co Wet Analysis

- ① Mixing · Reaction
- ② Confluence
- ③ Extraction
- ④ Phase separation
- ⑤ Confluence
- ⑥ Decomposition
- ⑦ Extraction
- ⑧ Phase separation
- ⑨ Confluence
- ⑩ Removal
- ⑪ Phase separation



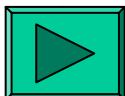
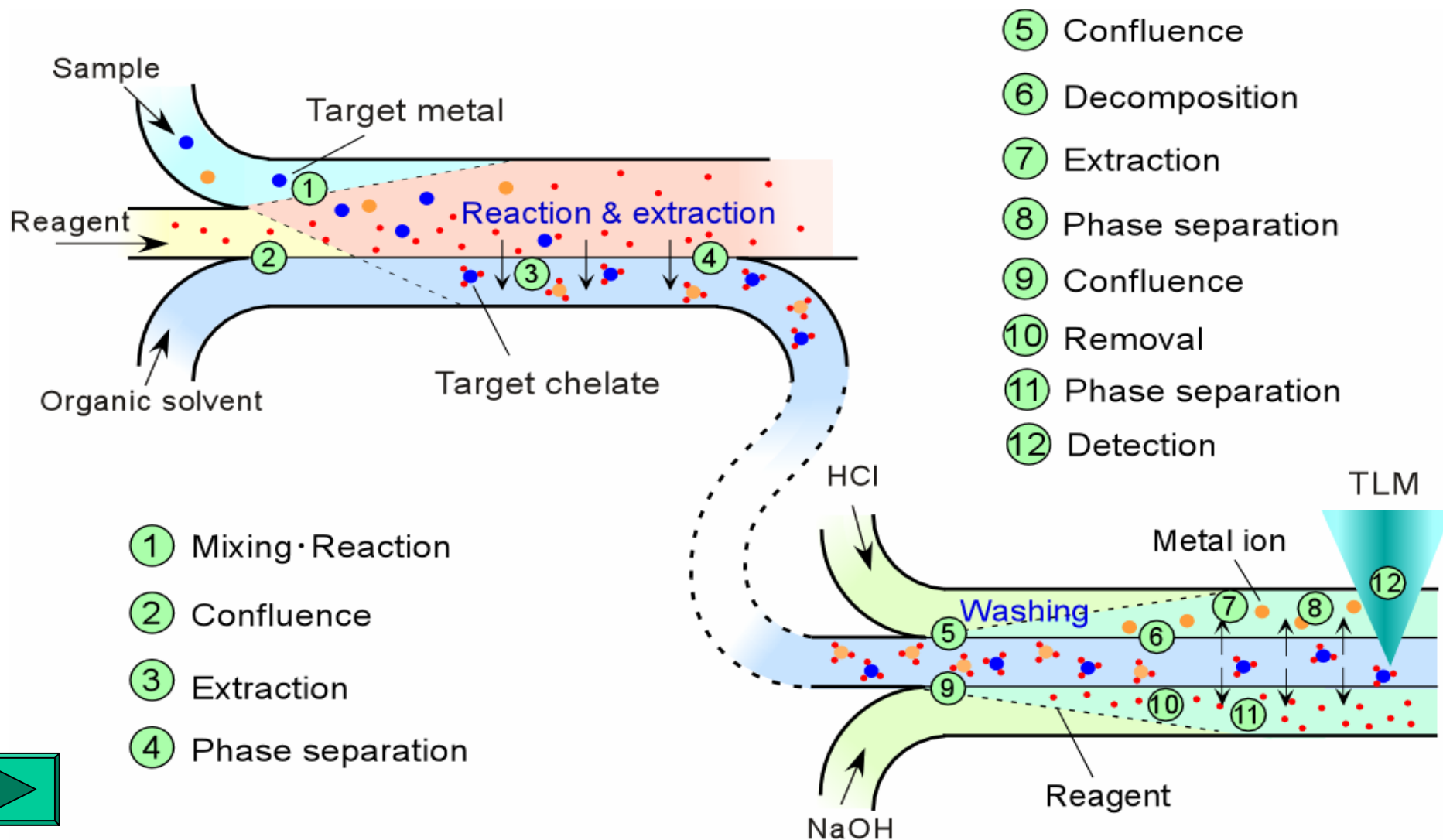
⑫ Detection

Same functions

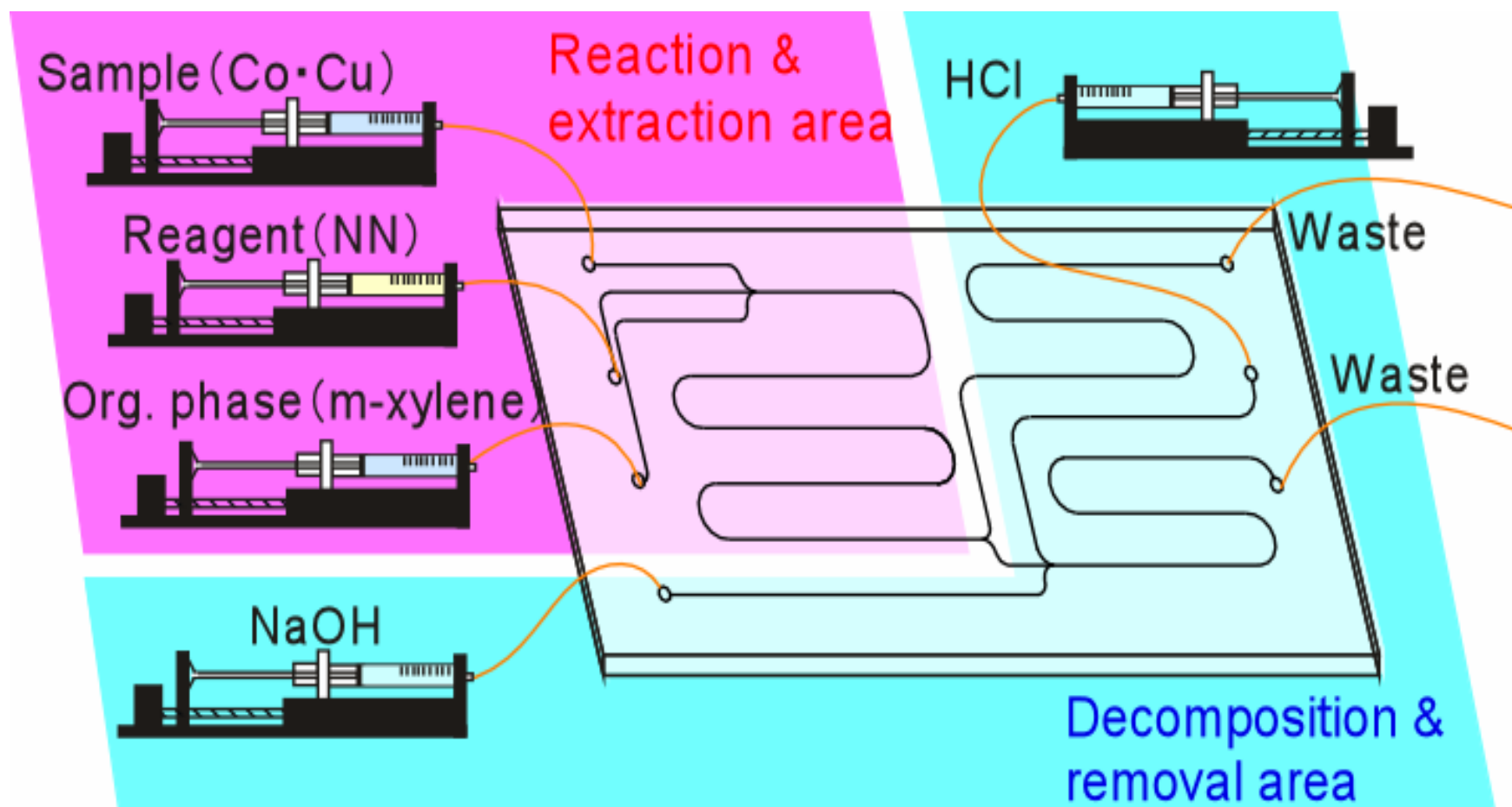


Integration

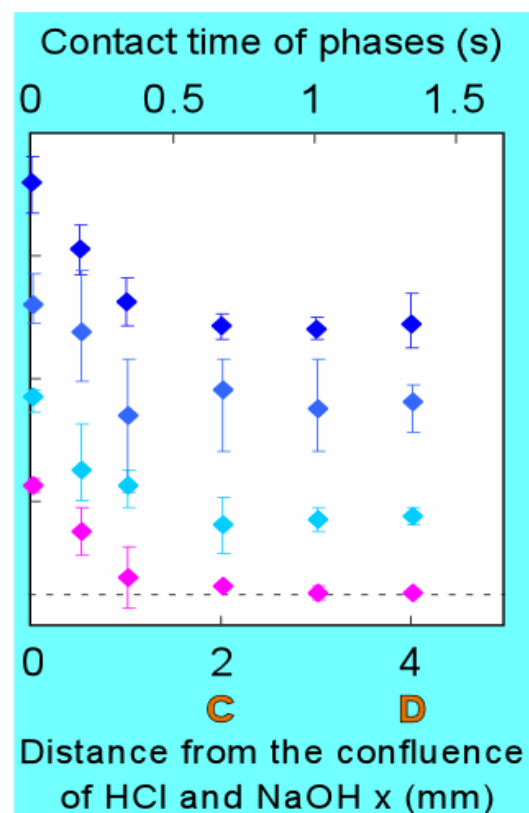
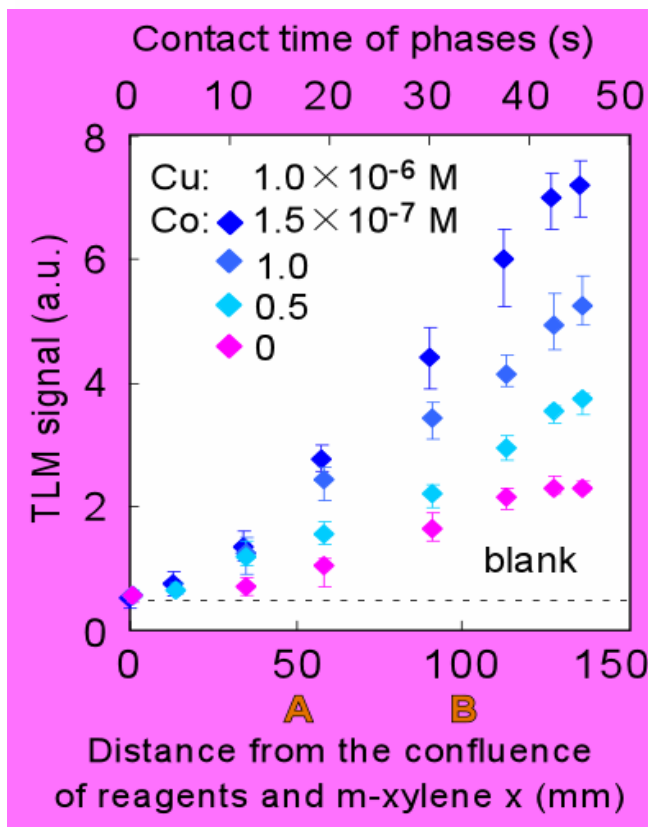
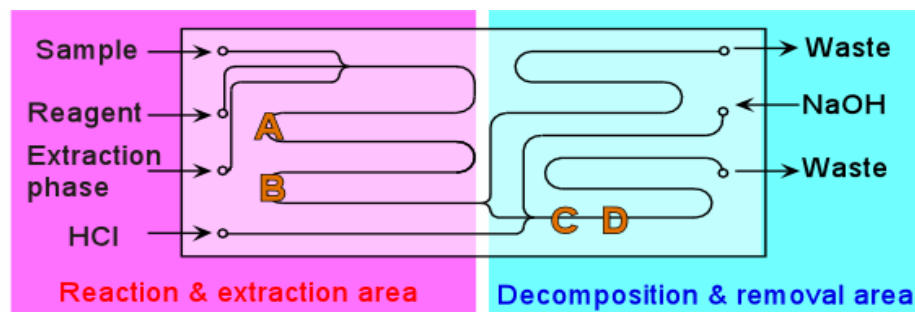
Combination of Micro Unit Operations required for Co Wet Analysis



Microchip and Experimental Setup

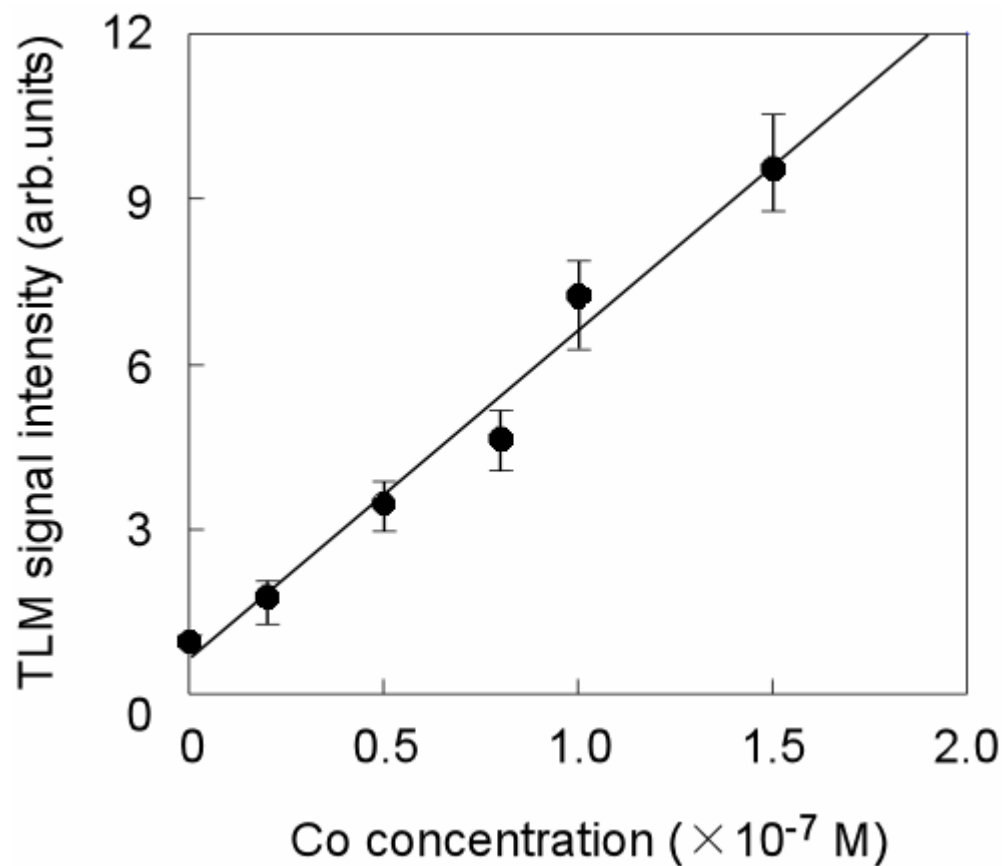


Co: Analyte Cu: Interfering



**Flow velocity:
3mm/s**

Calibration Curve

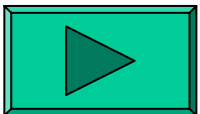
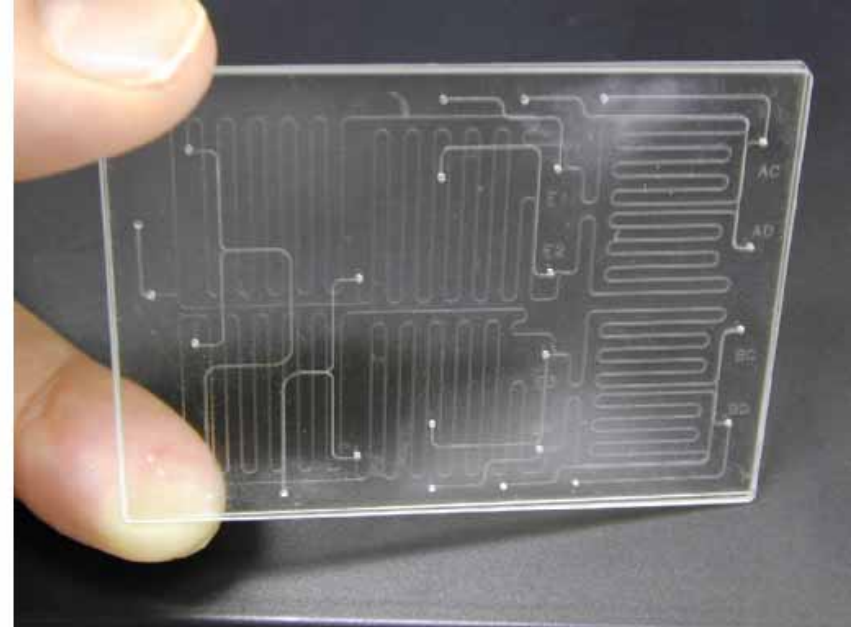
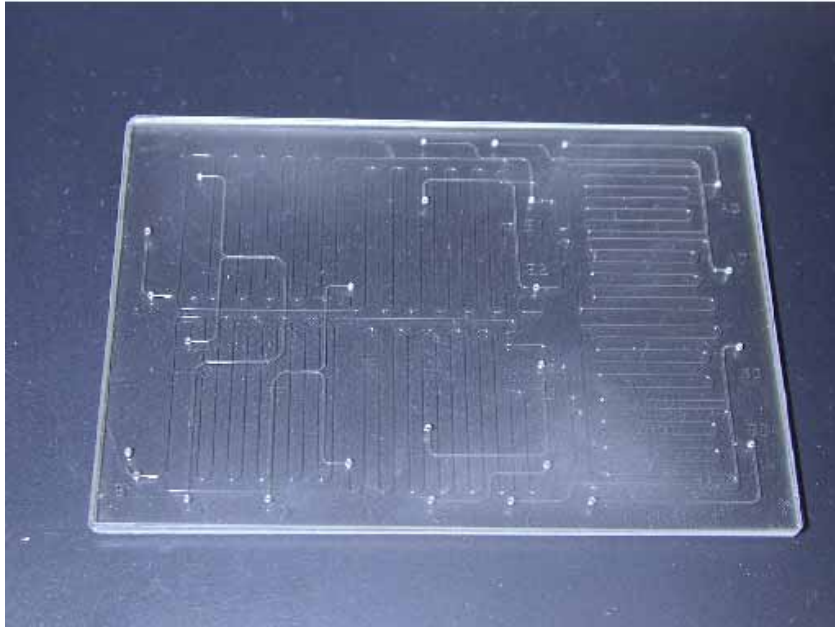


Limit of detection: 0.11×10^{-7} M

Absolute amounts
of detection: 0.08 zmol

3D CFCP (Ex. Fe & Co analysis)

Microchip With a 3-D Channel Network



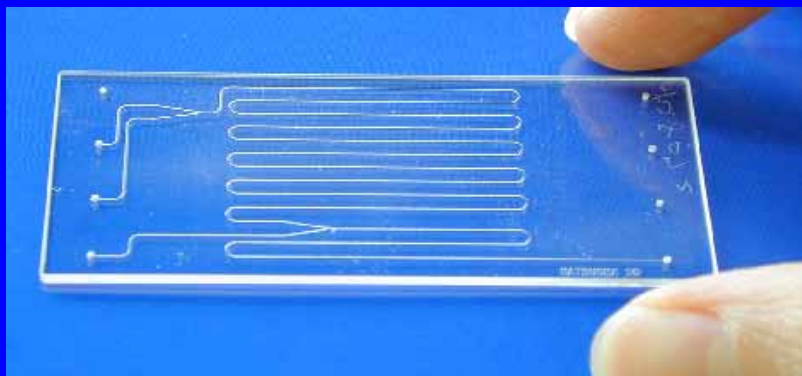
Multi-Sample Multi-Component Wet Analysis

| | Sample C Fe (aq.) | Sample D Co (aq.) |
|-----------|----------------------|----------------------|
| Reagent A | 41.0 | 0.6 |
| Reagent B | 0.2 | 12.3 |

Reagent A: bathophenanthroline

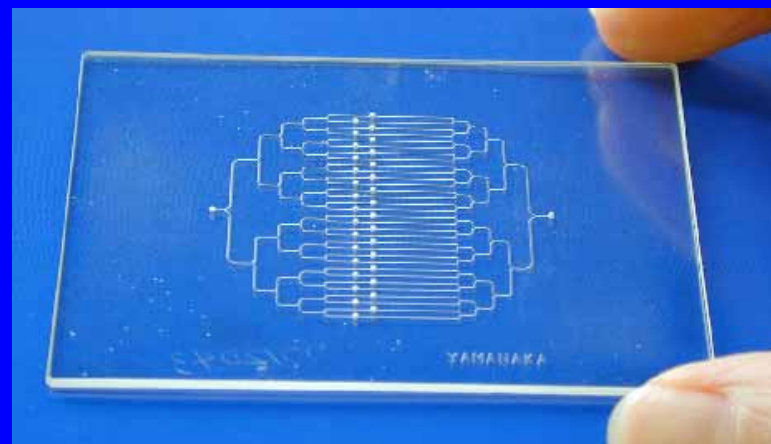
Reagent B: nitroso-PSAP

Examples of Integrated Chemical Devices



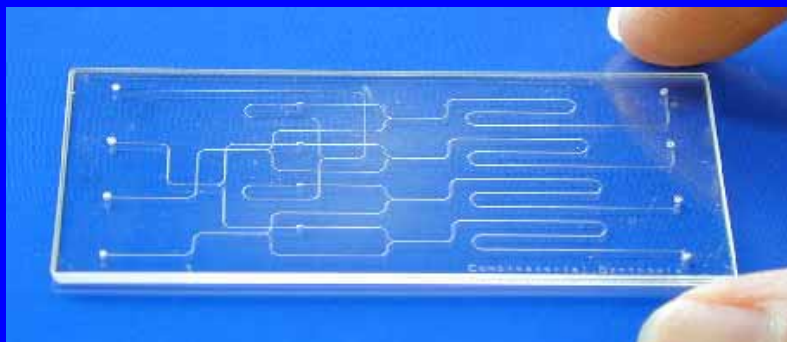
Chemical Analysis Device

- Environmental
- Biochemical



Immunoassay Device

- Cancer diagnosis
- Biochemical



Combinatorial Chemistry Device



Cell Biochemistry Device

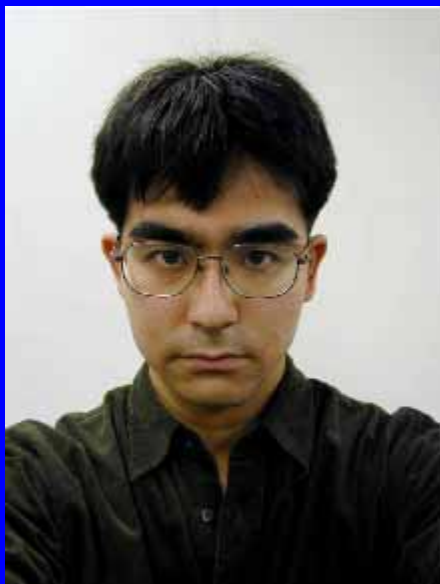
Conclusions

New methodology for integration of complicated chemical processing was established

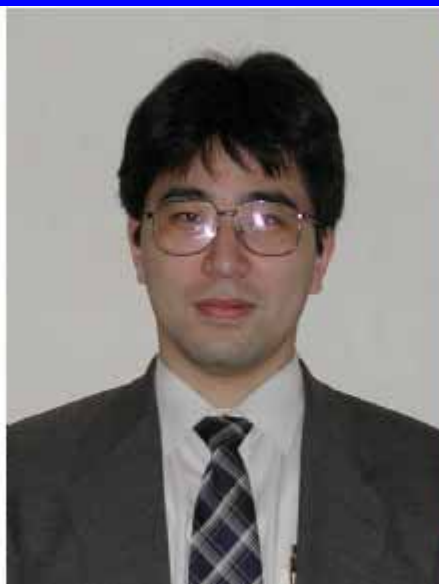


Using this methodology, we applied Co and multi-sample multi-component wet analysis system

Acknowledgements



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Thank you for your kind attention

Experimental Setup

