

高速流体制御を用いたオンチップミキシング

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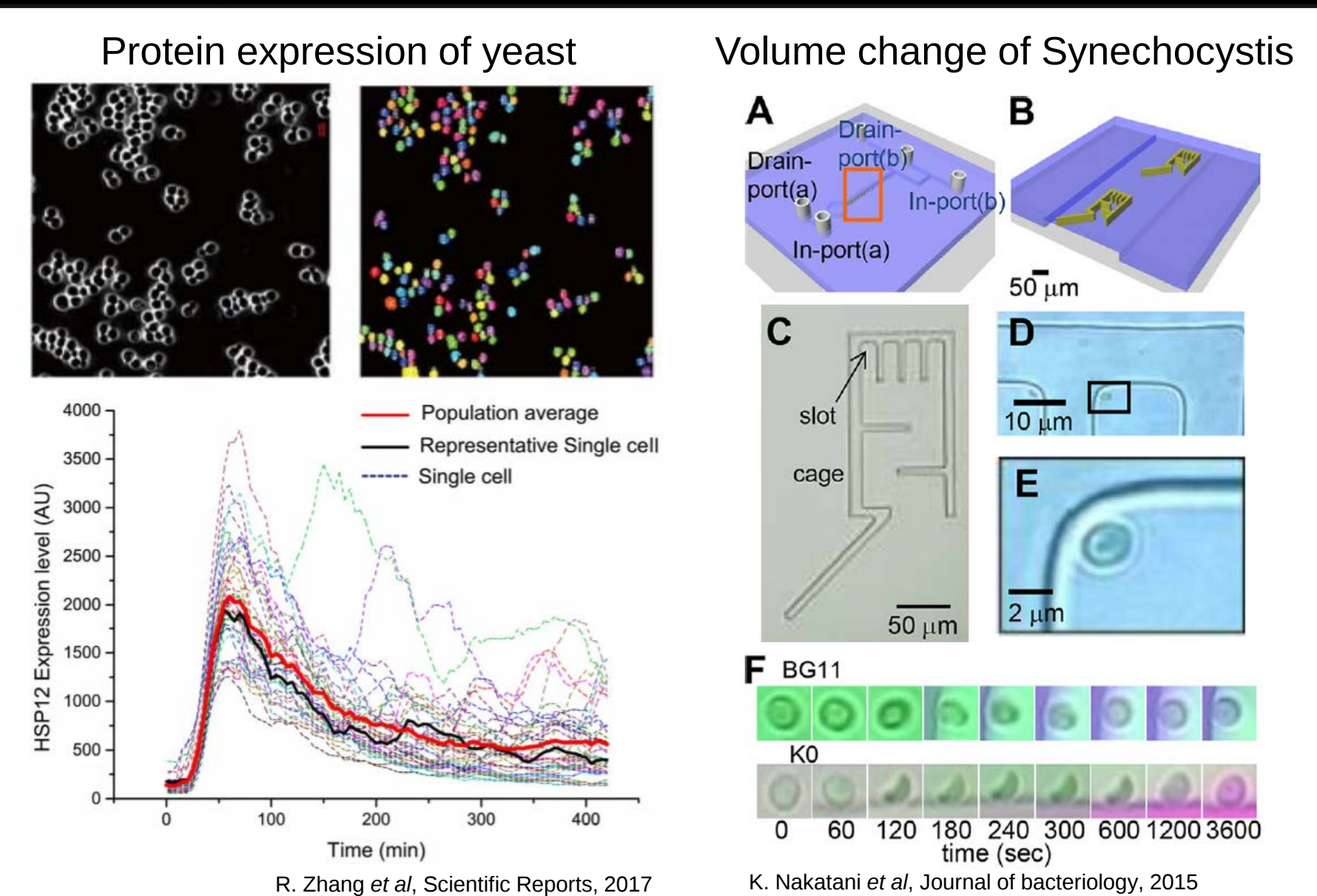


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局所渦を用いてマイクロ流体をミリ秒オーダーで混合!

Background : Dynamic stimulation



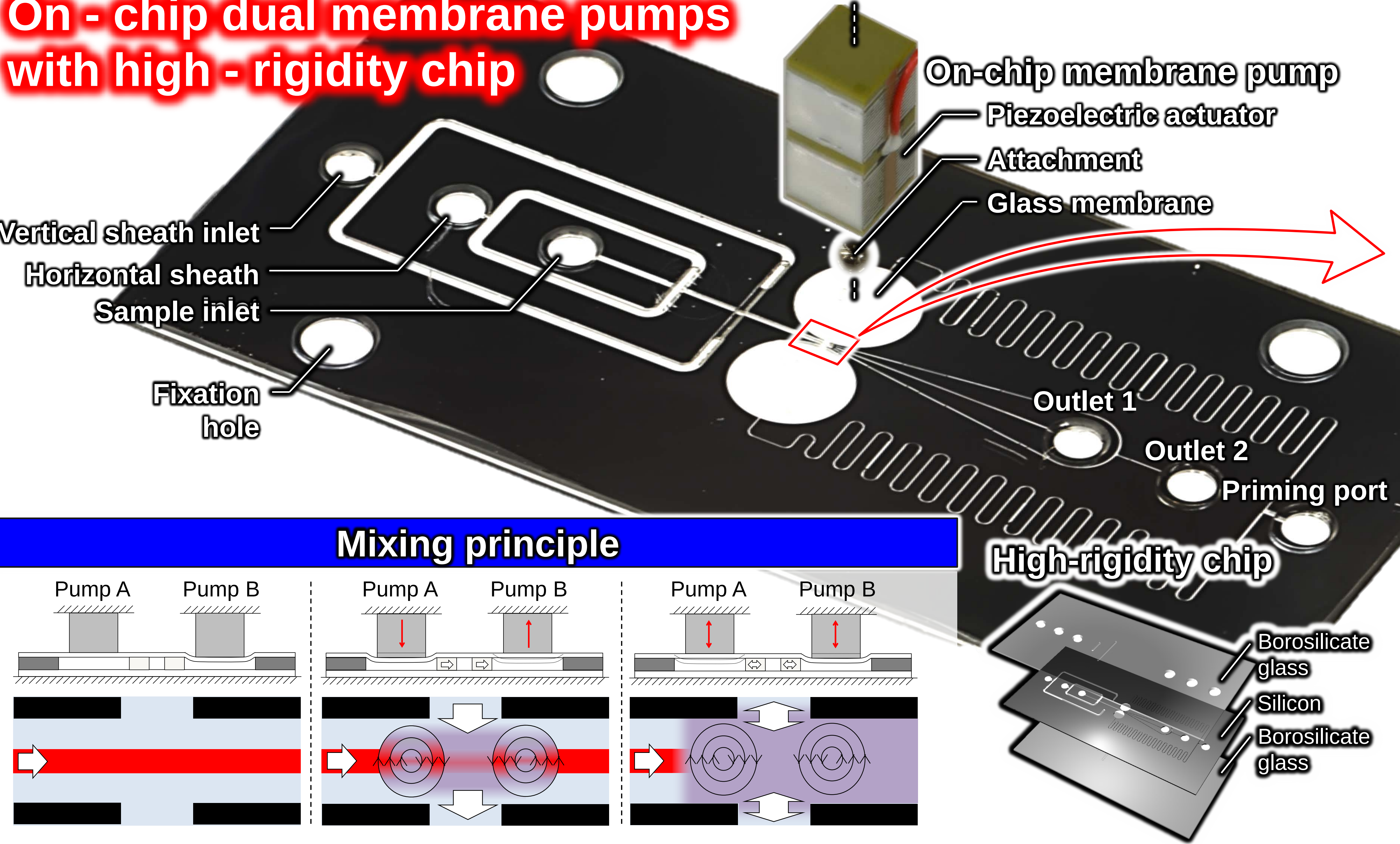
Next : msec-order stimulation method

Benchmark

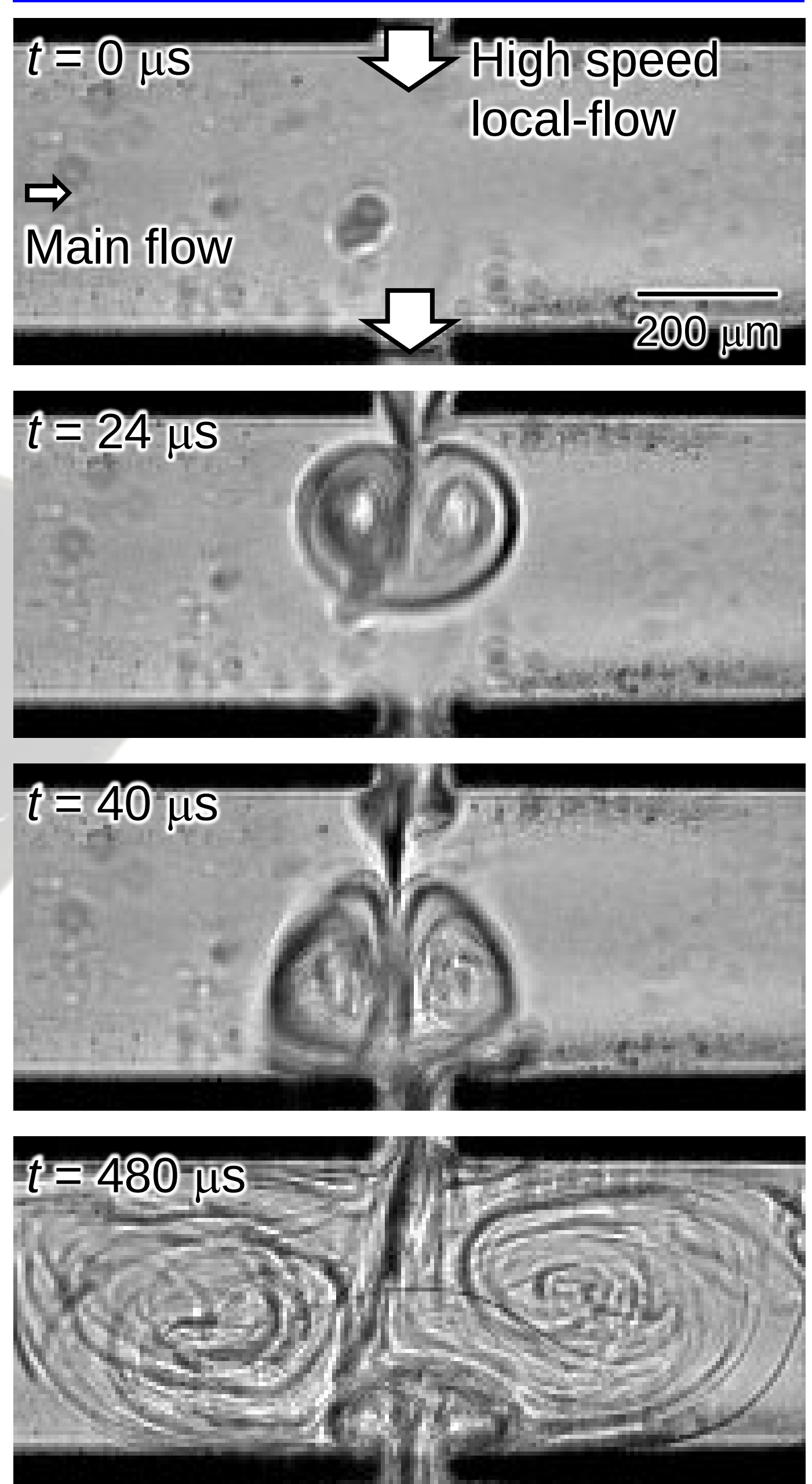
Type	Passive	Passive	Active
Methods	Narrow channel	Turbulent flow	Acoustic oscillation
Mixing time	≈ 1 ms	6.6 ms	≈ 100 ms
Dimensions of cross-section	(Width) x (Height) 200 x 8 μm	(Width) x (Height) 500 x 10 μm	(Width) x (Height) 400 x 50 μm
Remarks	• Simple configuration • Not on/off control	• Simple configuration • Not on/off control	• On/off control • Heating (≈ +40°C)

Active
Vortex using flow control
1.5 ms
(Width) x (Height) 200 x 200 μm
• On/off control • Few heating (≈ +4.1°C)

On-chip dual membrane pumps with high-rigidity chip



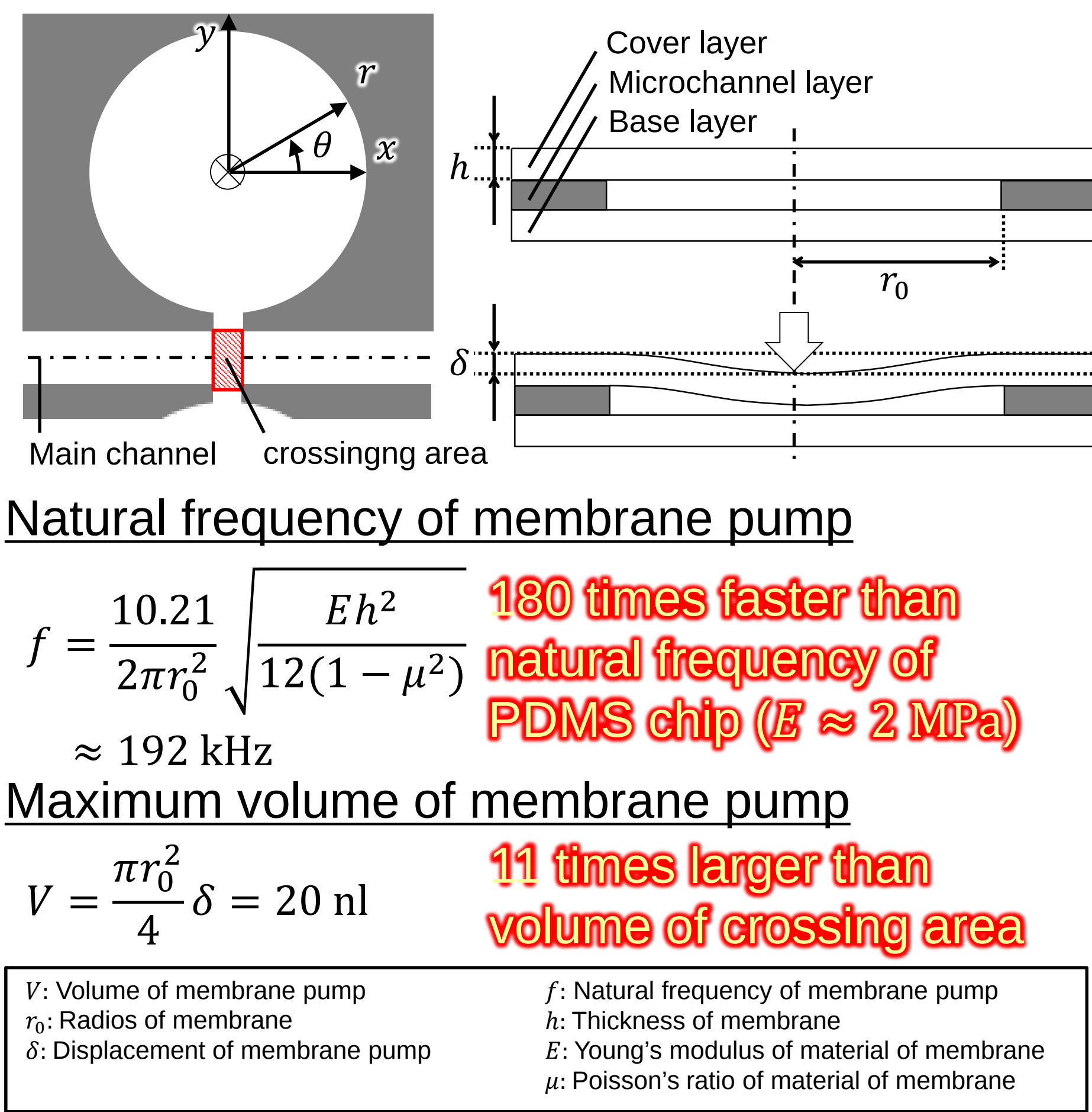
Vortex generation



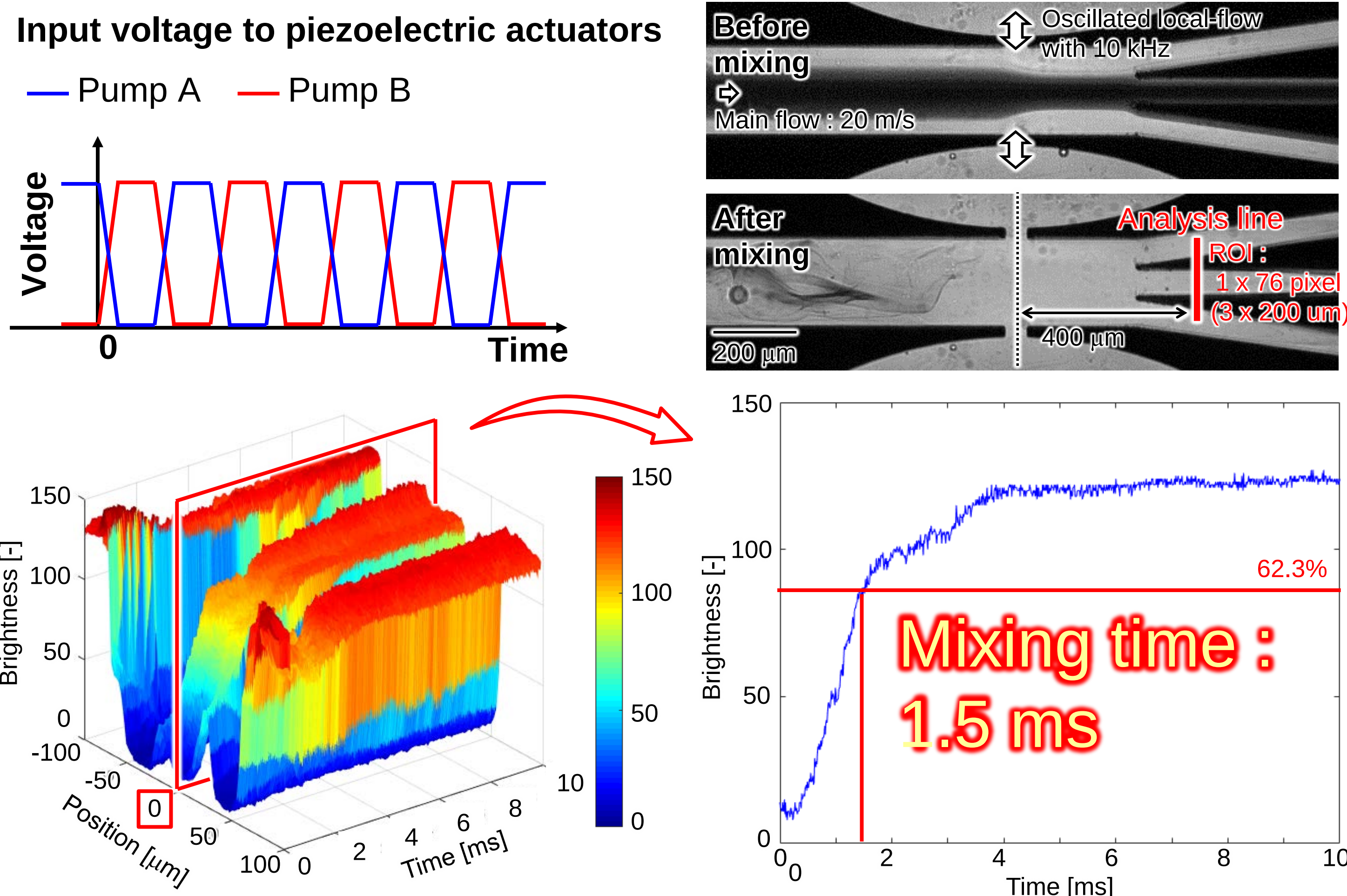
Chip fabrication

Base/Cover layer	Cover layer
(i) Patterning of etching mask	(v) Patterning of etching mask for sandblasting
(ii) HF etching and cleaning	(vi) Sandblasting
Channel layer	Packaging
(iii) Patterning of etching mask after anodic bonding	(vii) Anodic bonding
(iv) DRIE	
Legend: Si, Cr, Au, Glass, SU-8, SCM250, OFPR	

Analysis of membrane pump



Evaluation of mixing



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Abstract: In this paper, we propose an on-demand on-chip micromixer using local high-speed flow which generates vortices in a microchannel. The micromixer utilizes vortices for mixing by using high-speed flow control. We succeeded in generating vortices in a microfluidic chip within 28 μs. In addition, we successfully demonstrated on-demand mixing by applying various input signals to the micromixer. The mixing was about 1.5 ms, which is 66 times faster than previous mixing methods using acoustic oscillation.



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