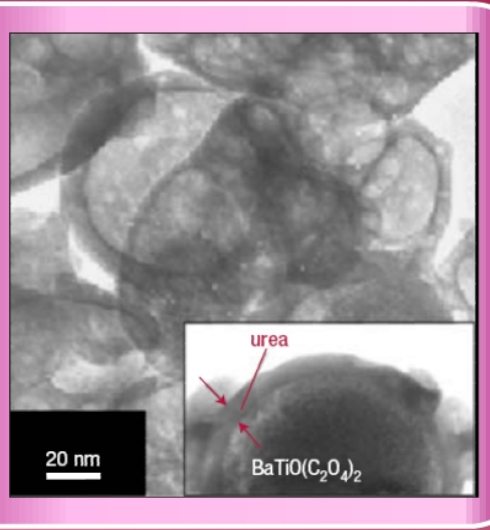
ER FLUID ACTUATED MICROFLUIDIC CHIP

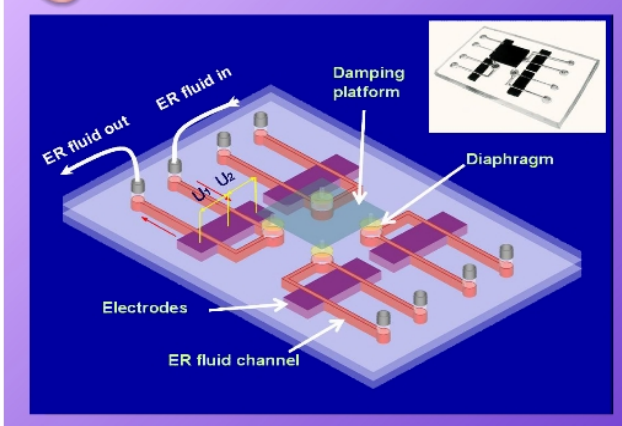
INSTITUTE OF NANO SCIENCE & TECHNOLOGY AND DEPARTMENT OF PHYSICS

ELECTRORHEOLOGICAL (ER) FLUID

This smart material consists of nano-sized dielectric particles dispersed in a liquid, whose rheological properties are controllable. Simply speaking, it will change from liquid to solid and back to liquid with external electric field within milli-seconds.

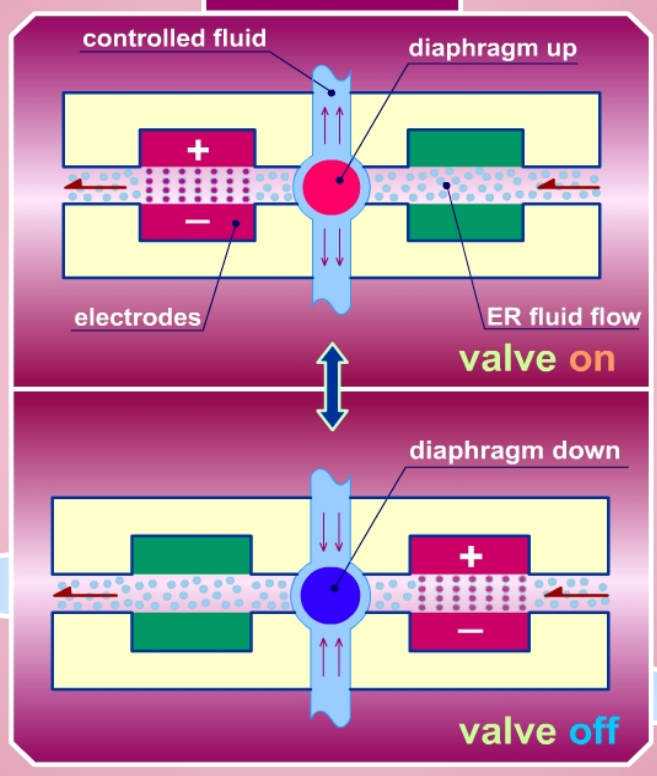


Flexible Platform

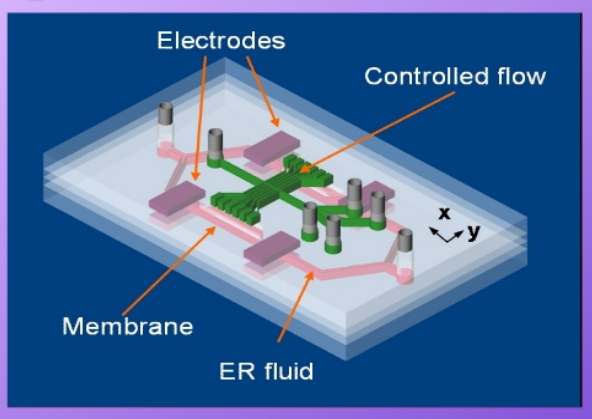


The chip sustains and controls the micro-platform with four pillars. Heights of the pillars could be individually controlled by the isolated four ER fluid channels.

ER VALVE

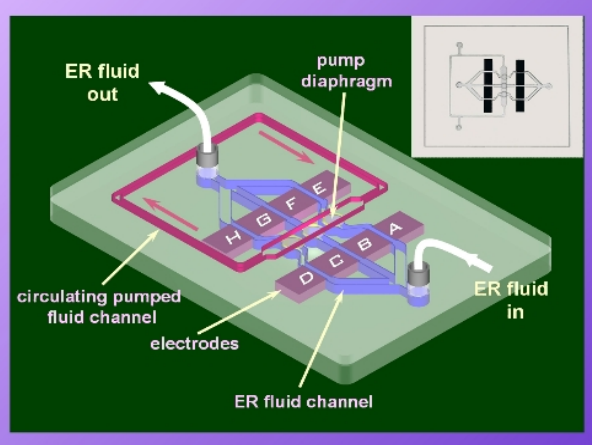


Microfluidic mixer



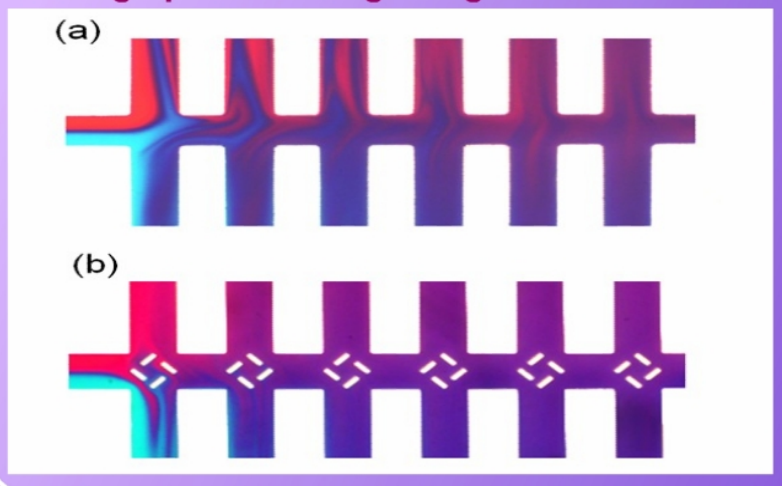
The microfluidic chip is constructed with multi-layer structure. The flow in the main channel is perturbed by liquid flow in orthogonal side channels, driven by hydrodynamic pulsating pumps, where chaotic mixing can be achieved within short passage distances .

Microfluidic Pump



The microfluid is circularly flowing and driven by ER fluid valves

Micrographs of mixing along channels



Micrographs of mixing along the unbaffled (a) / baffled (b) channel. The picture (b) indicates that more effective high frequency microfluidic mixing will be obtained by adding baffles in the main channel, which would induce the interface line to encounter more bifurcation points during high frequency oscillations.

REFERENCES:

- Liyu Liu, Xiaoqing Chen, Xize Niu, Weijia Wen and Ping Sheng, "Electrorheological fluid actuated microfluidic pump", ***Appl. Phys. Lett.*** **89**, 083505 (2006).
- Xize Niu, Liyu Liu, Weijia Wen and Ping Sheng, "Hybrid Approach to High-Frequency Microfluidic Mixing", ***Phys. Rev. Lett.*** **97**, 044501 (2006).
- Liyu Liu, Xize Niu, Weijia Wen and Ping Sheng, "Electrorheological fluid-actuated flexible platform", ***Appl. Phys. Lett.*** **88**, 173505 (2006).
- Xize Niu, Liyu Liu, Weijia Wen and Ping Sheng, "Active microfluidic mixer chip", ***Appl. Phys. Lett***. **88**, 153508 (2006).
- Xize Niu, Weijia Wen and Yee-Kuen Lee, "Electrorheological-fluid-based microvalve" , ***Appl. Phys. Lett***. **87**, 243501 (2005).
- Weijia Wen, Xianxiang Huang, Shihe Yang, Kunquan Lu and Ping Sheng, "The giant electrorheological effect in suspension of nanoparticles", ***Nature Materials*** **2**, 727 (2003).