A micro surface tension pump (MISPU) on a glass microchip (Electronic Supplementary Information)

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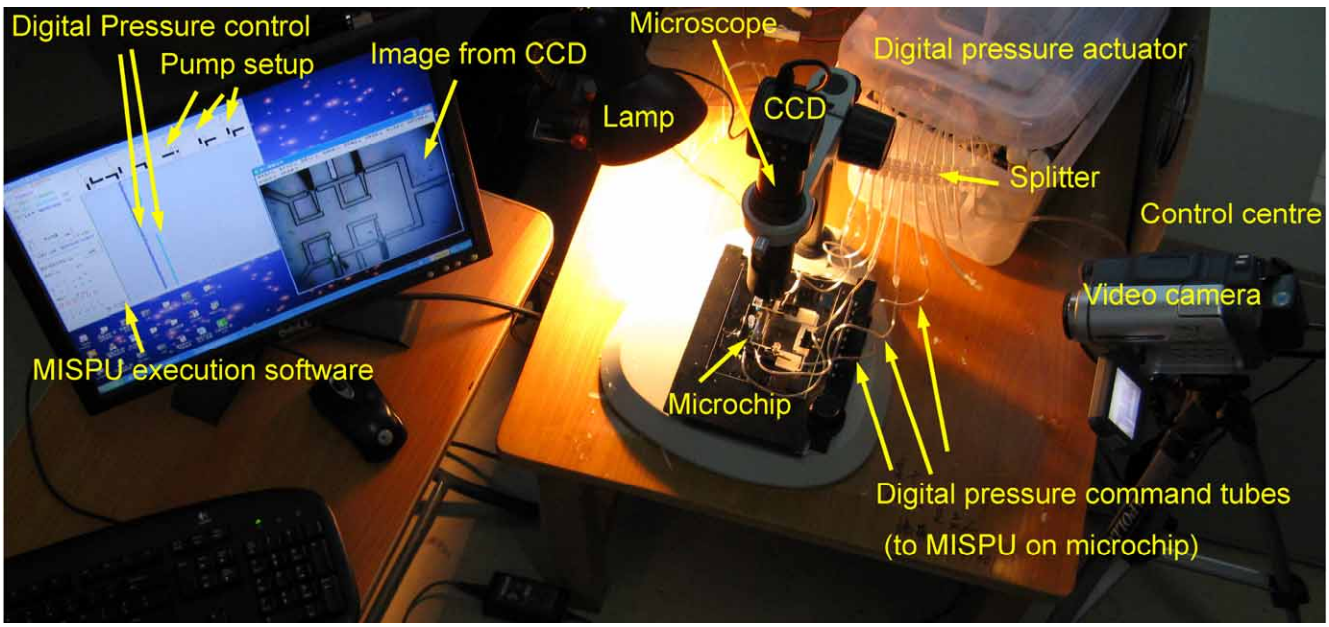


Fig. S1 Test instrumentation setup. The microchip for MISPU experiments under a microscope (1x objective) with a CCD was monitored by a video camera (illuminated by a lamp), simultaneously. A computer program set the digital pressures and the time schedule of a MISPU cycle. The computer sent driving commands via a COM port to the control centre and digital pressure actuator. The digital pressure commands were then split by six plastic tubes to the valves and pistons on the microchip.

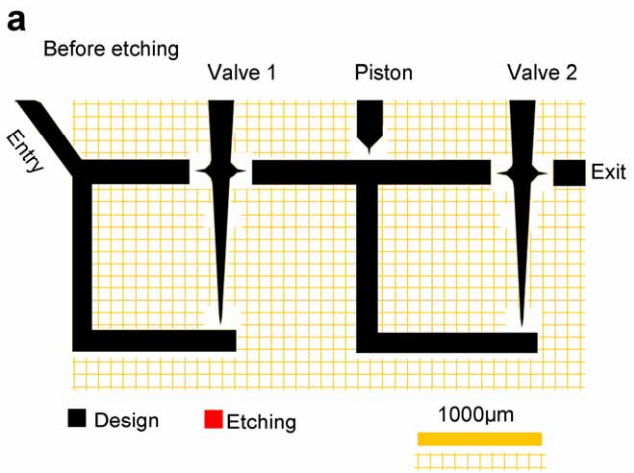


Fig. S2 Glass etching. The valves and pistons were design on a photomask (**a**). The channels on photomask were separated by a distance of 75μm. After glass etching (40μm) (**b**), the patterns on the glass chip expanded and channels contacted each other to form MISTAs for gas-liquid interface blocking.

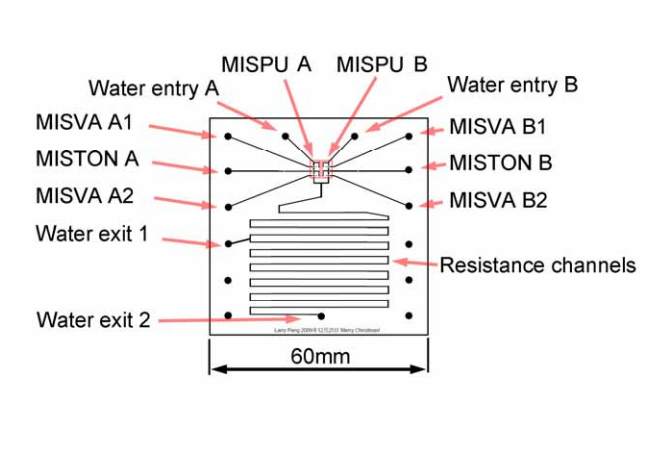
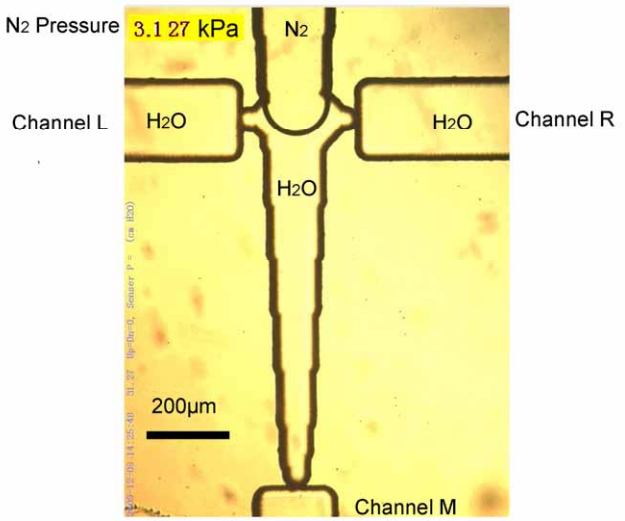
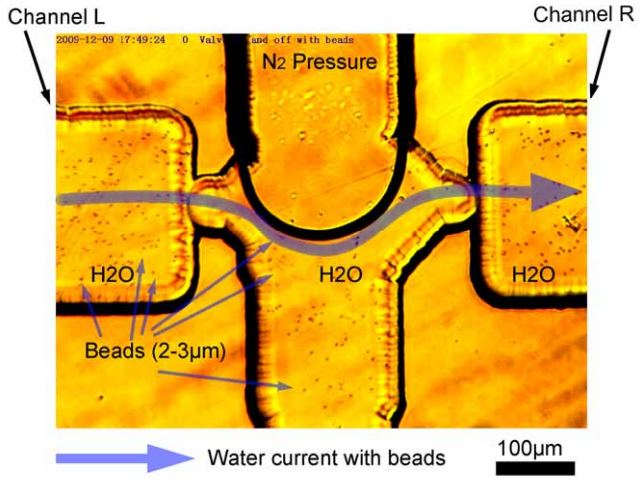


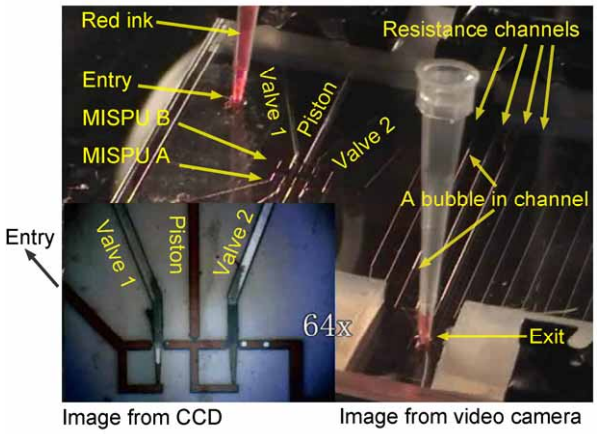
Fig. S3 Glass chip design. The glass chip contains two MISPU (MISPU A and MISPU B). Each MISPU has its own entry and valves and pistons. The two MISPU have a conjunct zigzag channel (resistance channel) as an exit (short for exit 1 and long for exit 2).



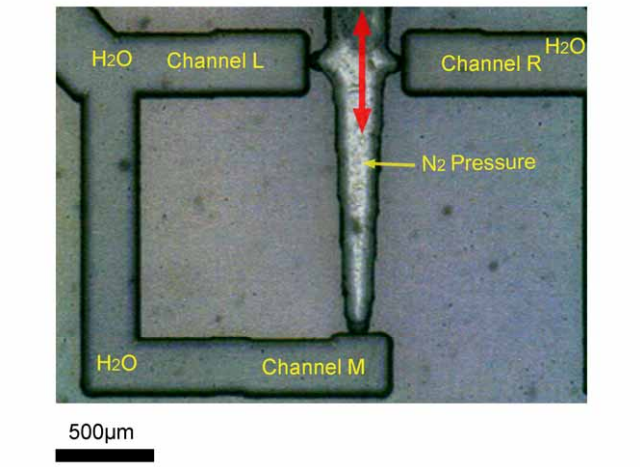
Video 1 The pressure responses of a MISVA. The MISVA, including the three channel (L, R and M), was filled with water. Gas pressure (N_2) drove the gas-water interface into the valve. The moving distance of the interface was measured. Pressure on channel L, R and M were set to 0.



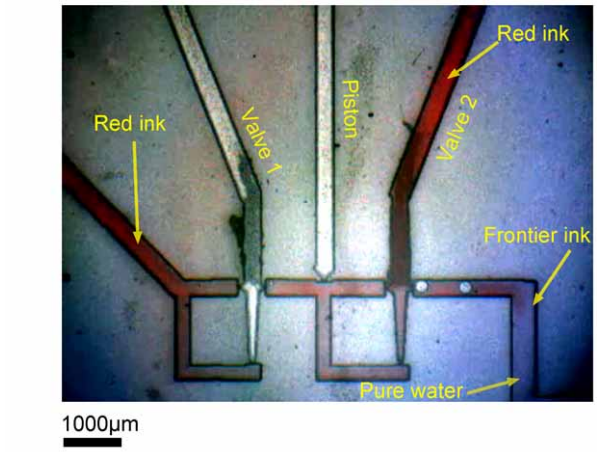
Video 2 The flow controlled by MISVA. Flow from channel L to channel R was driven by pressure difference. The movement of the interface controlled by N_2 pressure closed or opened the valve to interrupt the flow or to bring back the flow.



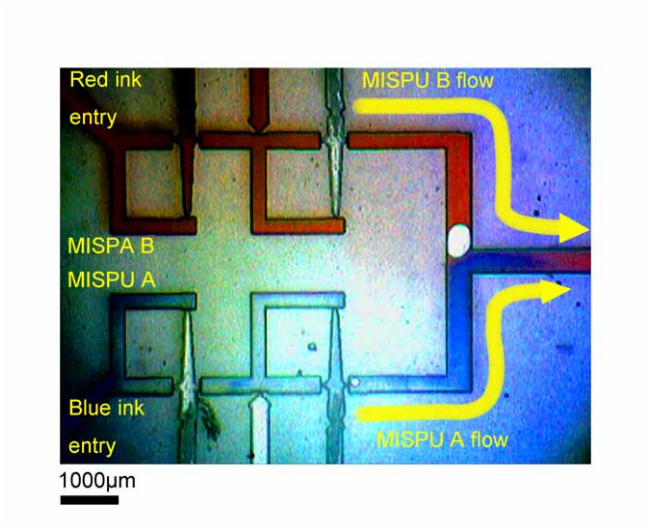
Video 4 The working of a MISPU. The working state was shown by a microscope CCD and the whole microchip was shown by a video camera (SONY). Red ink filled the entry and MISPU B pumped the red ink into the resistance channel. The pump's power was strong enough to drive a long bubble in the resistance channel into the tip on top of the exit.



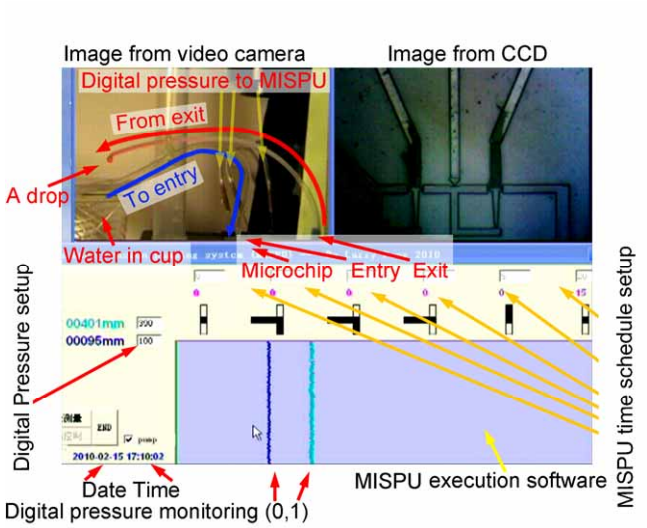
Video 3 A long term valve tests. A MISVA opened and closed 2000 times in 1000s. The red arrow shows the gas-water interface moving back and forth driven by digital pressure.



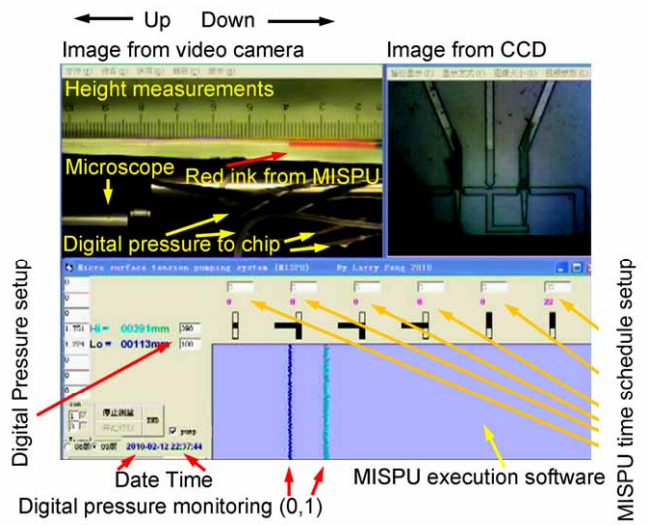
Video 5 The pumping mechanism of MISPU. The MISPU was pumping pure water followed by red ink. The frontier of ink depicts the movements of liquid in a working MISPU.



Video 6 A dual MISPU. Two MISPUs were integrated together on the chip. Each MISPU (A and B) was pumping different ink (A for blue and B for red).



Video 8 A durability test of a MISPU. The digital pressures and the pumping time schedule were set by the MISPU execution software. The working state of the MISPU was monitored by a microscope CCD. The water in a cup was pumped up and back into the cup (recorded by a video camera). The tests lasted 7 days.



Video 7 The pump output of a MISPU. The digital pressures and the pumping time schedule were set by the MISPU execution software. The working state of the MISPU was monitored by a microscope CCD and the pump output measurement was recorded by a video camera (image lying down 90 degree of counter clockwise).

Notes and references

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