Electronic Supplementary Material (ESI) for Lab on a Chip.

Real-time two-photon-lithography in controlled flow to create a single-microparticle-array and particle-cluster-array for optofluidic imaging

Bing Xu,[1] Yang Shi,[1] Zhaoxin Lao,[1] Jincheng Ni,[1] Guoqiang Li,[1,2] Yanlei Hu,[1]* Jiawen Li,[1] Jiaru Chu,[1] Dong Wu,[1]* and Koji Sugioka[2]

[1]CAS Key Laboratory of Mechanical Behavior and Design of Materials, Department of Precision Machinery and Precision Instrumentation, University of Science and Technology of China, Hefei 230026, China.

[2]Key Laboratory of Testing Technology for Manufacturing Process of Ministry of Education, Southwest University of Science and Technology, Mianyang 621010, China

Email: huyl@ustc.edu.cn and dongwu@ustc.edu.cn

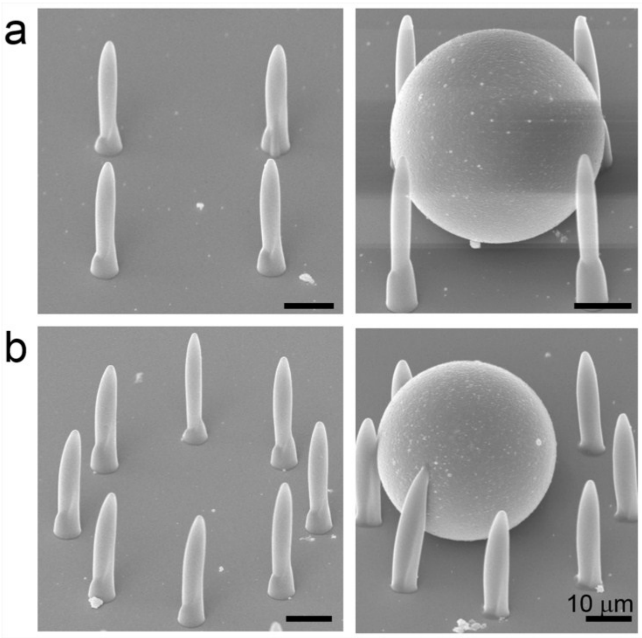

Fig. S1 45º view of the four and eight trapping pillars. The left images are the trapping pillars only and the right ones show that 20 μm particles are trapped inside the pillars.

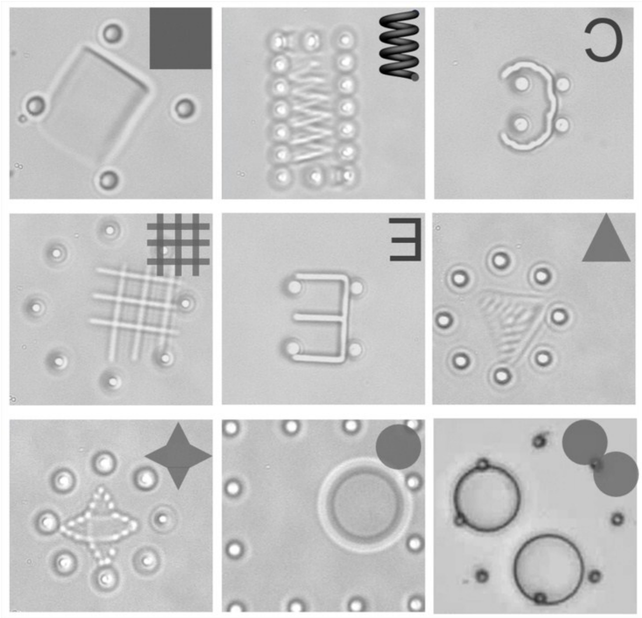

Fig. S2 ‘C’, ‘E’, springs and other shape particles are trapped by the SFTPL method. Two particles also are trapped in identical structure simultaneously.

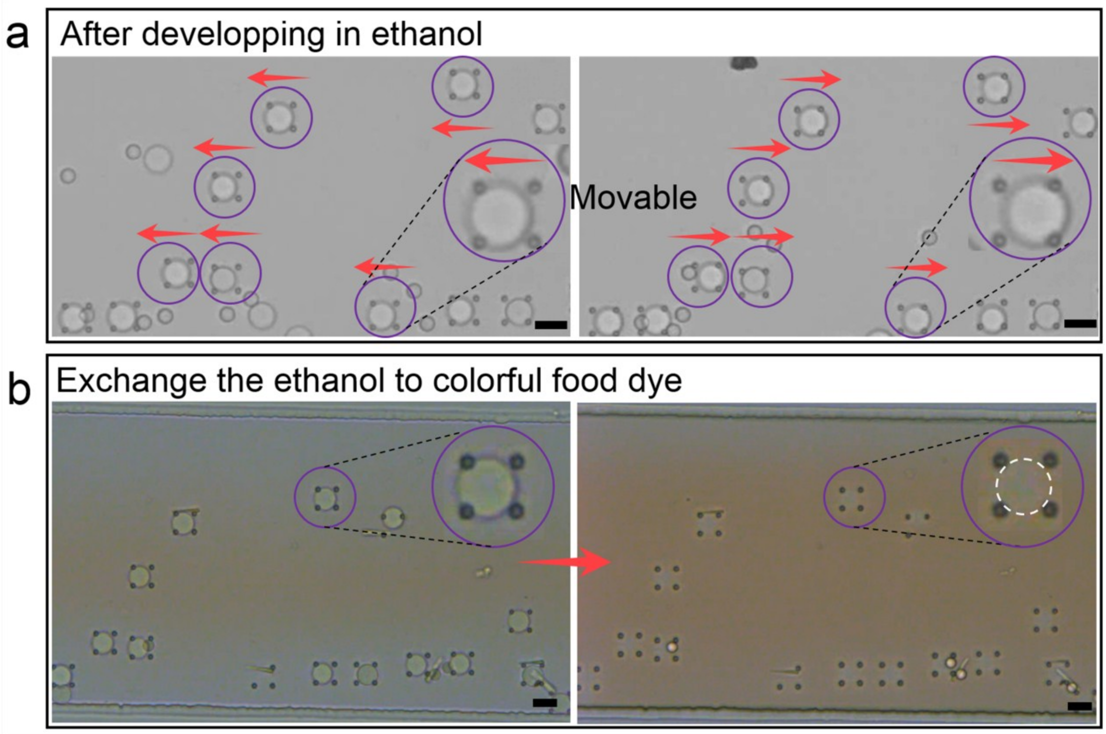

Fig. S3 Exchanging the solution for following research. a) shows that after developing, the trapped particles are all movable and not adhered by the pillars, meaning that the pillar space size is ok and the laser power is suitable. b) Colorful food dye is injecting into the microchip. After the microchannel is filled of the food dye, the trapped particles can not be seen because the particles and the dye have a same refractive index.

	300 mw，10 ms	500 mw，1 ms	Multifoci (4 foci), 1 ms
The production (/h)	9000	90000	360000

Table. S1 The single-trap production is about 9000 /h without considering the stopping time when the laser power is 300 mW and exposure time is 10 ms, and the production can be improved to be 90000 in larger power and lower exposure time (e.g. 500 mW, 1 ms). By using a spatial light modulator (SLM) to generate 4 foci, the production can be in a rate of 360000/h.

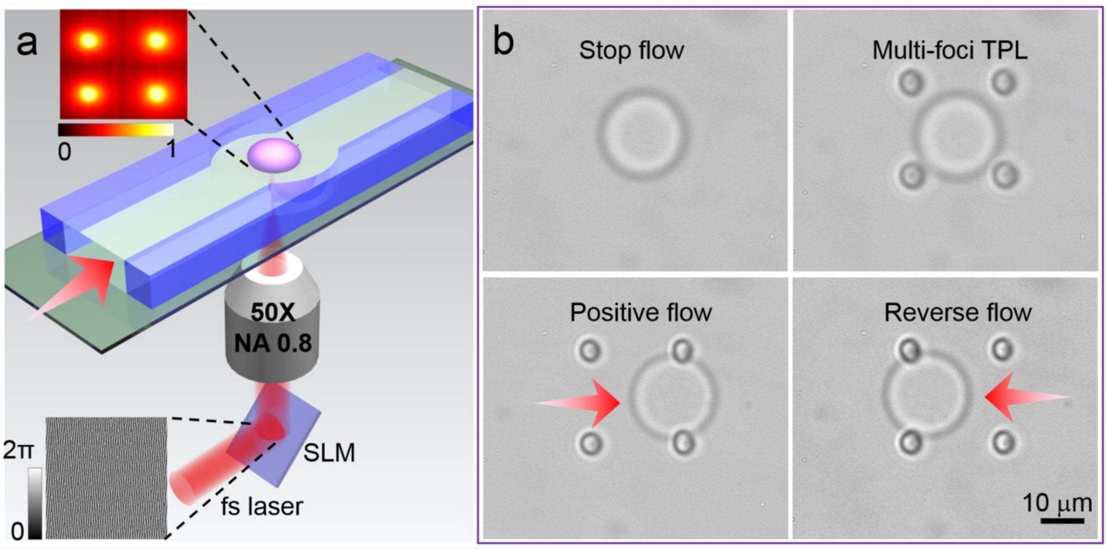

Fig. S4 Multifoci (4 foci) real-time single-particle-trap system. a) shows the fabrication system by adding a spatial light modulator before the objective to split the single beam to 4 beams. b) shows the 4 foci real-time trapping a 20 μm particle and that it still will not damage the particle.

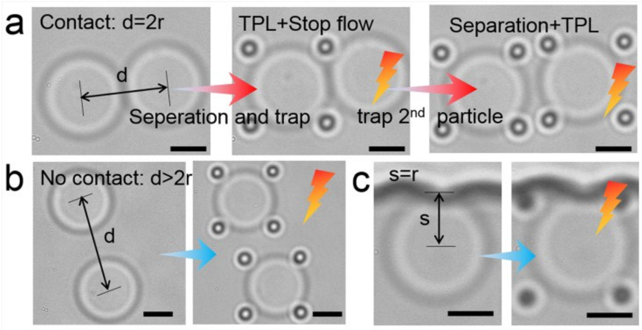

Fig. S5 a) shows that two contact particles can be separated and trapped in one-bead-to-one-trap. Firstly, we stop the particles-cluster and one particle is trapped without damaging the another particle; then, the two particles are separated via a gentle positive flow; after that, we stop the liquid again and trap the second particle. b) shows the convenient trapping of non-contact two particles. c) Particles sticking to wall can also be trapped easily.

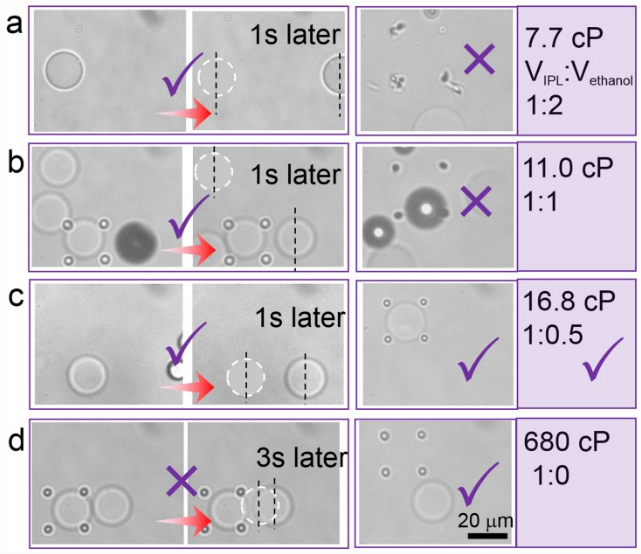

Fig. S6 a) shows that the viscosity of IPL is 7.7 cP, which is not suitable for particles trapping. Although the liquid flow is fast, the ultra-low concentration of photoinitiator leads to no-pillars generation. b), c) and d) show that the suitable viscosity of IPL is 16.8 cP because of its easy flow and thick pillars creation. At this case, the volume ratio of IPL and ethanol is 1:0.5.

Supporting Video 1. Four pillars for real-time trapping a 20 mm particle without damaging the particle.

Supporting Video 2. Eight pillars for real-time trapping a 20 mm particle without damaging the particle.

Supporting Video 3. Multi-particle trapping with controlled number (e.g., 4 particle).