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

Supporting Information

A Femtoliter On-Demand Droplet Dispensing System Based on Gigahertz Acoustic Resonator

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Device fabrication

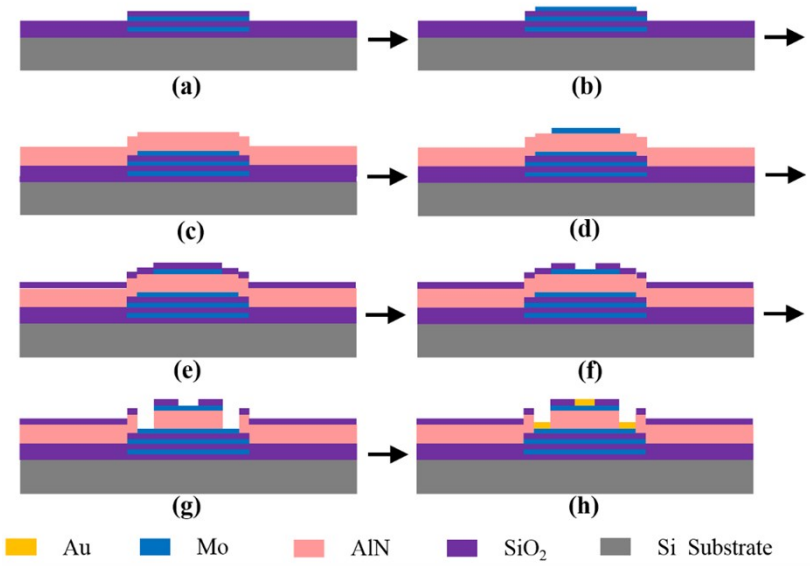

Figure S1 Device fabrication process. (a)-(b) Deposition and etching of bottom electrode. (b)-(c) Deposition of piezoelectric layer. (c)-(d) Deposition and etching of top electrode. (d)-(e) Deposition of SiO2 passivation layer. (e)-(f) Etching the passivation layer to expose top electrode. (f)-(g) Etching the piezoelectric layer to expose bottom electrode. (g)-(h) Deposition and lift-off of Au electrode.

Table S-1 Detail parameters and fabrication method for each layer of the resonator

Layer	Material	Thickness	Fabrication method
Passivation layer	SiO2	0.1μm	Chemical vapor deposition
Au electrode	Au	3μm	Physical vapor deposition
Top electrode	Mo	0.15 μm	Magnetron sputtering
Piezoelectric layer	AlN	1.1 μm	Magnetron sputtering
Bottom electrode	Mo	0.17 μm	Magnetron sputtering
Bragg reflectors	SiO2	0.645 μm	Chemical vapor deposition
	Mo	0.642 μm	Magnetron sputtering
Substrate	Si	400 μm	

Viscosity effect

To investigate the ability of the device for dispensing liquid droplets with high viscosity, liquid samples with different viscosity were prepared by mixing glycerol with ultra-pure water at different ratio. The printing results are shown in Fig. S2. The results clearly show that the acoustic device can handle liquids with a wide range of viscosity and liquid droplets with viscosity as high as 15.2 mPa•s were successfully printed.

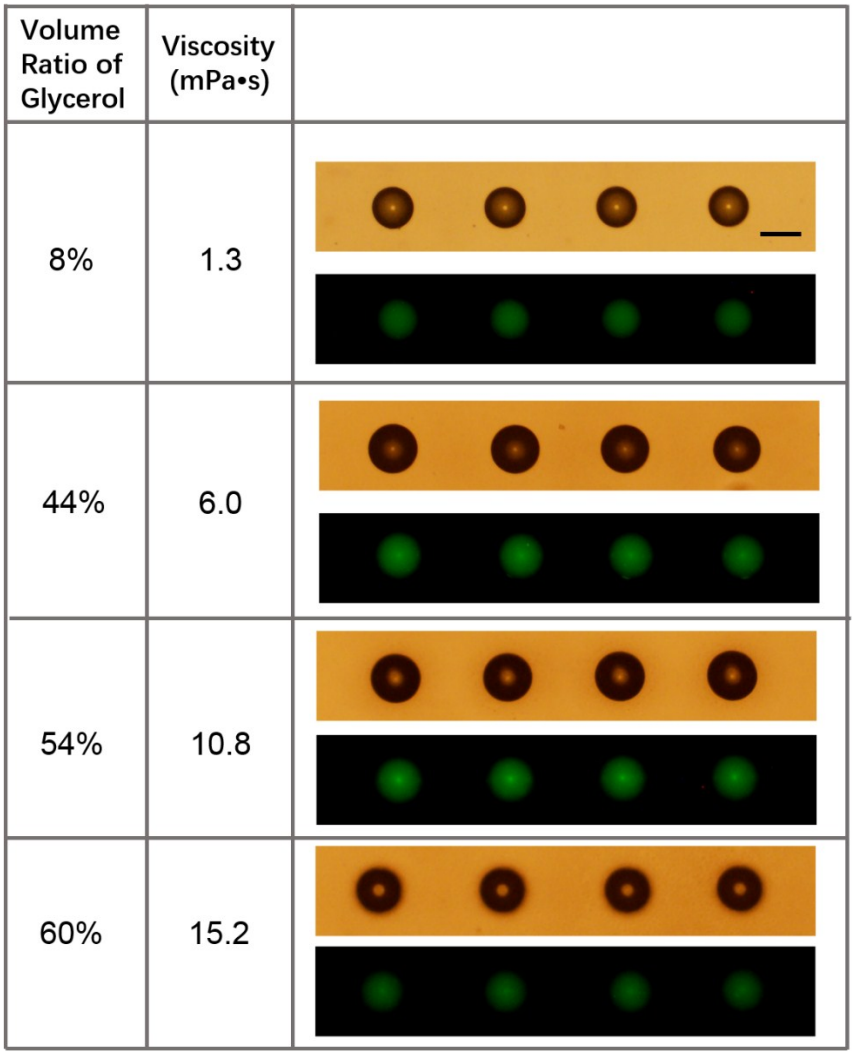

Figure S2 Printed droplets with varied viscosity. The results in each group consist of bright field photograph and fluorescent field photograph. The scale bar is 100 μm.

Cell printing

We also printed solution containing living cells and further treated with trypan blue (Fig. S3). It shows that cells can be successfully printed with retained bioactivity, since no cells get stained. Furthermore, it also shows that the device has potential in printing single cell array.

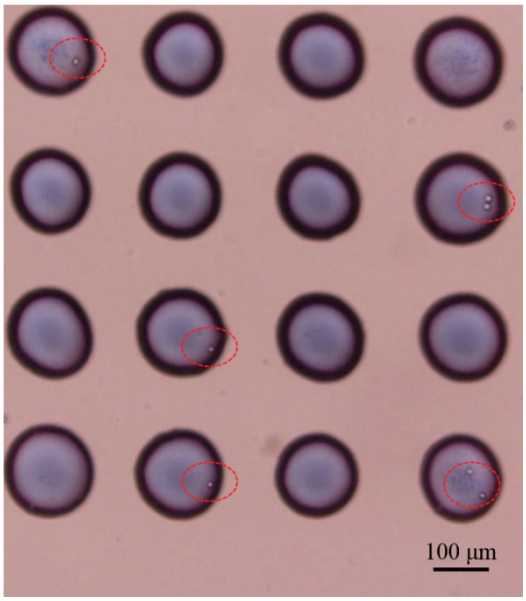

Figure S3 Printed droplet array with living HeLa cells and trypan blue. Cells are circled in red dash line.