

Supplementary Information for

Electrochemical Chip Integrating Scalable Ring-Ring Electrode Array to Detect Secreted Alkaline Phosphatase

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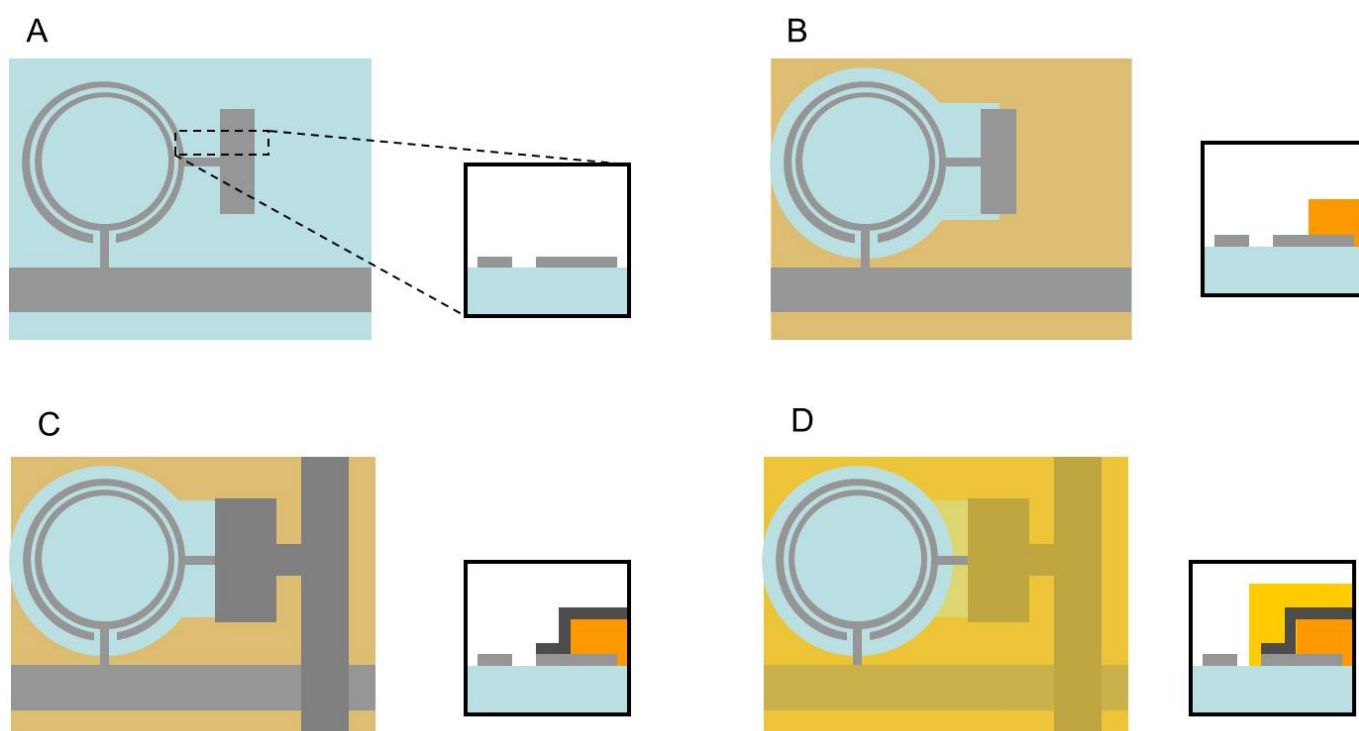


Figure S1 Fabrication process of the scalable ring-ring electrode array device. Photoresist S1818 was spin coated. (A) The first Ti/Pt layer is sputtered (Ti/Pt = 50/100 nm) to fabricate an electrode pattern after the lift-off process. Inner-ring with its lead electrode and the outer-ring without the lead electrode are fabricated. (B) A mixture of SU-8 3005 photoresist and SU-8 developer (1:1 (v:v)) is spin coated (3000 rpm, 30 s), developed, and hard-baked at 180 °C for 30 min. (C) The glass slide is treated with O₂ plasma, and the second Ti/Pt layer is sputtered (Ti/Pt = 50/100 nm) to fabricate the lead electrode of the outer-ring. Lift-off is done using acetone. (D) Finally, an insulator layer of SU-8 3005 is formed and hard-baked at 180 °C for 30 min.

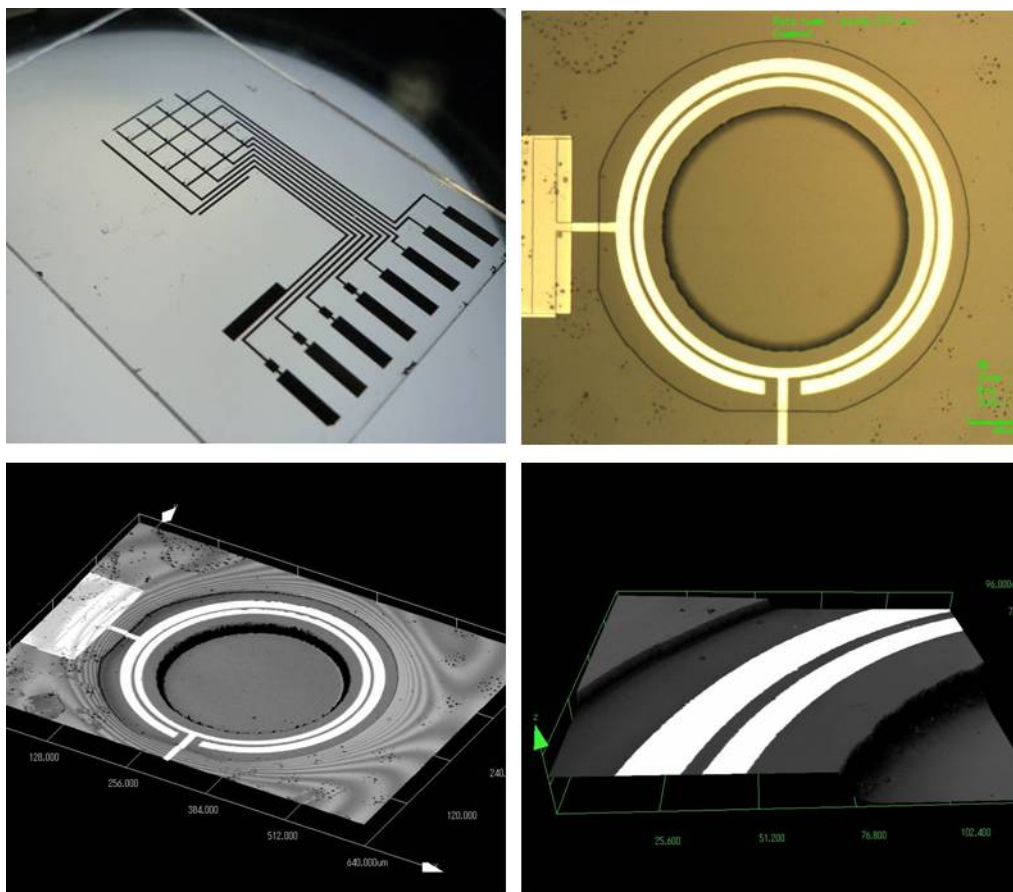


Figure S2 Photographs and magnified view of the scalable ring-ring electrode array device. The optimized dimensions of the ring-ring electrode array are as follows: inner-ring electrodes with a width of 10 μm , outer-ring electrodes with a width of 15 μm , and a gap of 5 μm between the two electrodes (inner ring: 310 μm i.d. and 330 μm o.d.; outer ring: 340 μm i.d. and 370 μm o.d.). The depth and the diameter of the microwell fabricated by wet etching are 11 and 267 μm , respectively. The total thickness of the photoresist double layer is 5.4 μm . The volume of the microwell is 1.29×10^{-10} L when it is covered with a PDMS block.

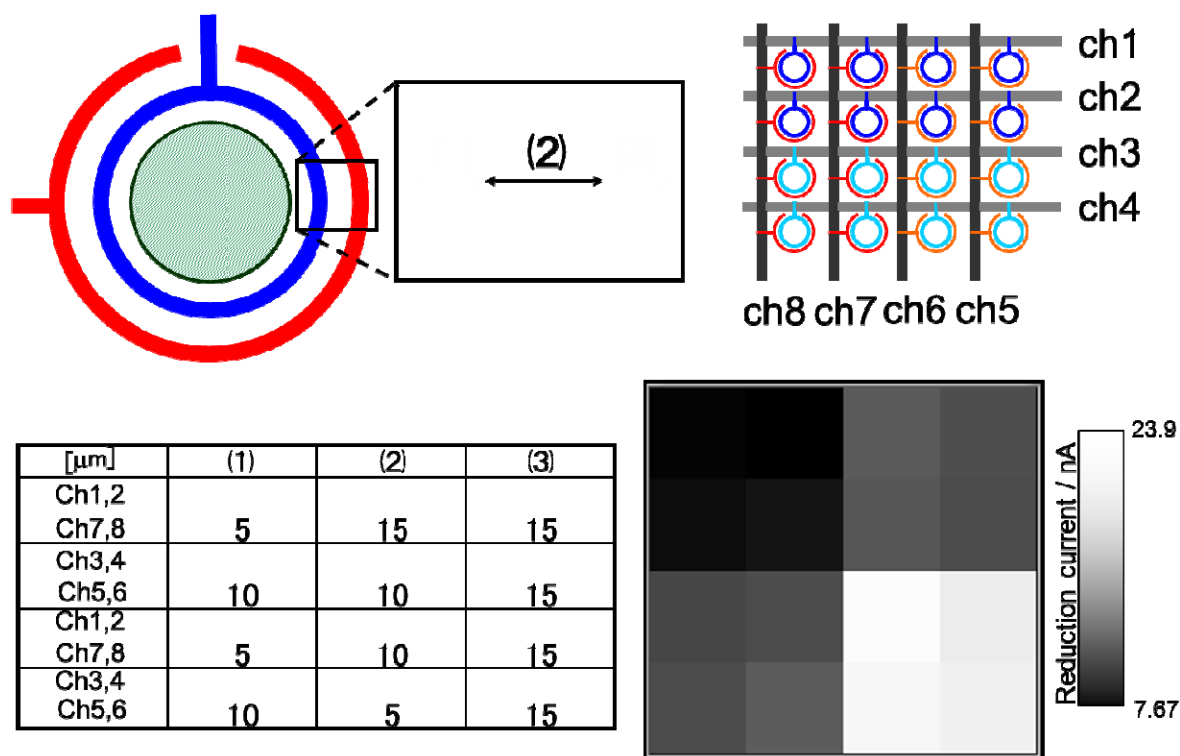


Figure S3 Geometry of the scalable ring-ring electrode array device with different dimensions on a single chip and electrochemical images (16 pixels) of the reduction current response for the device. The measuring solution is 0.5 mM ferrocenemethanol in 0.1 M KCl. The potential of the row electrode is stepped to +0.4 V for 6.0 s instead of +0.3 V for 6.0 s in the electrochemical imaging operation process, as mentioned in “Electrochemical Measurement” section. The highest reduction current responses were obtained when the ch3 and ch4 are selected as inner-ring row electrodes, and ch5 and ch6 as the outer-ring column electrodes.

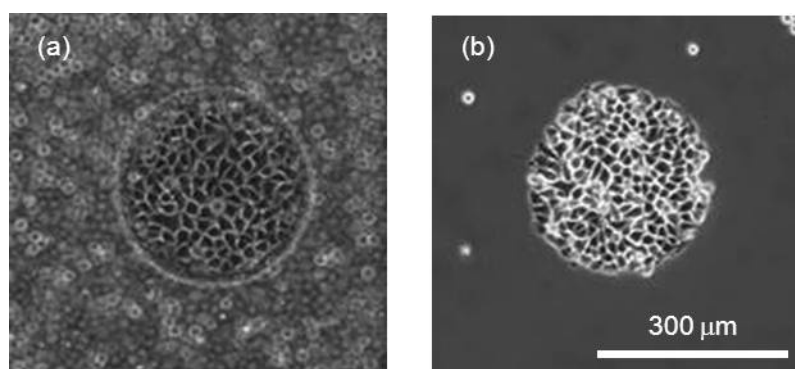


Figure S4 HeLa cells seeded on PDMS stencil-attached glass substrate featuring a cylindrical microwell fabricated by wet etching. Cells are incubated at 37 °C for 6 h (a). After removing the PDMS stencil, a round cellular pattern is observed to be formed (b).