

Supplementary Information

Origami Paper-based Sample Preconcentration using Sequentially Driven Ion Concentration Polarization

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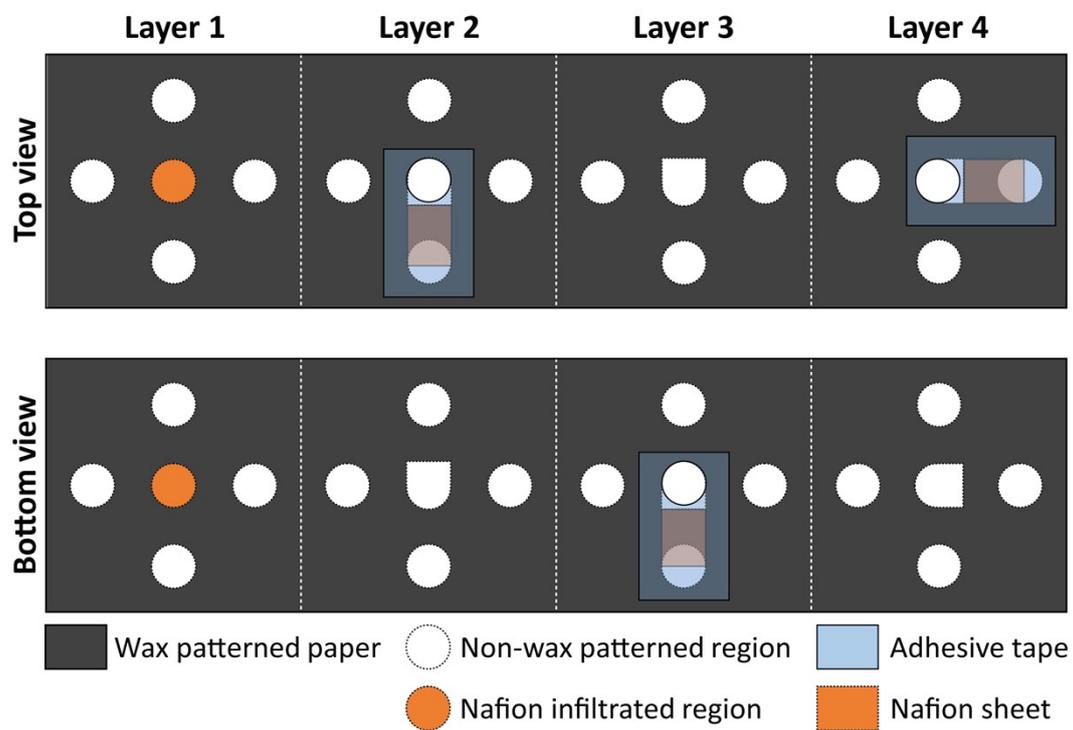
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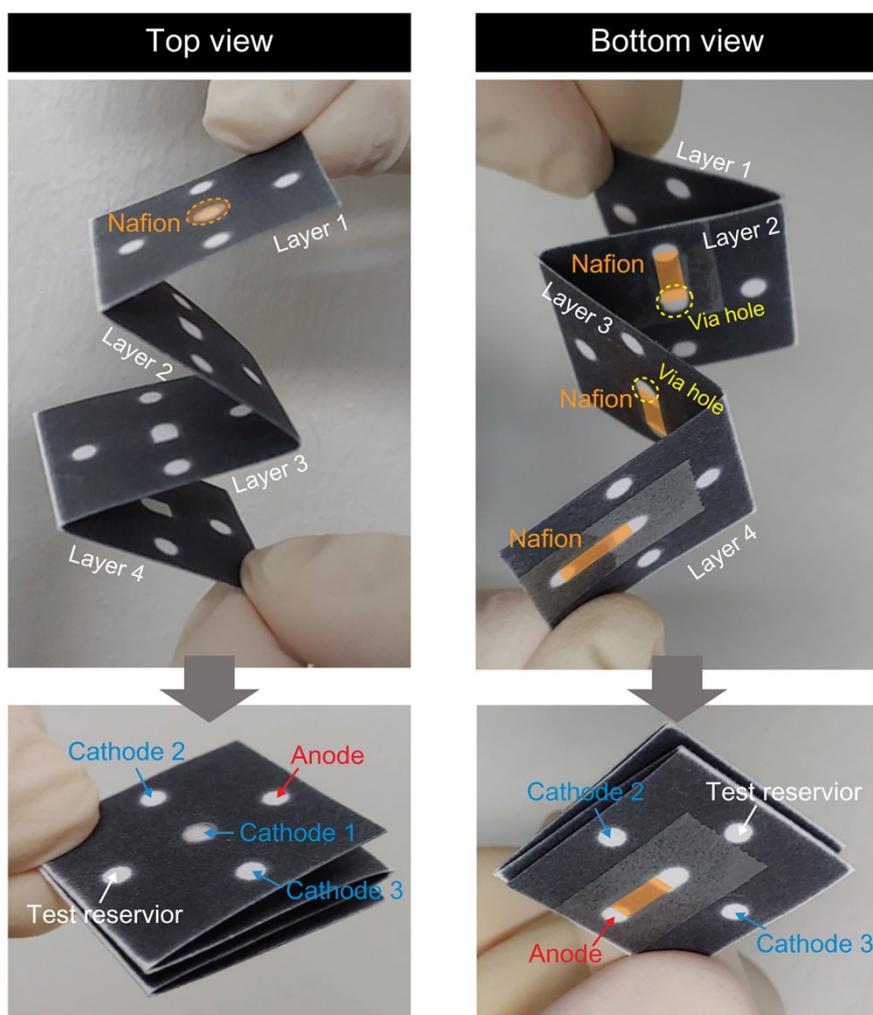
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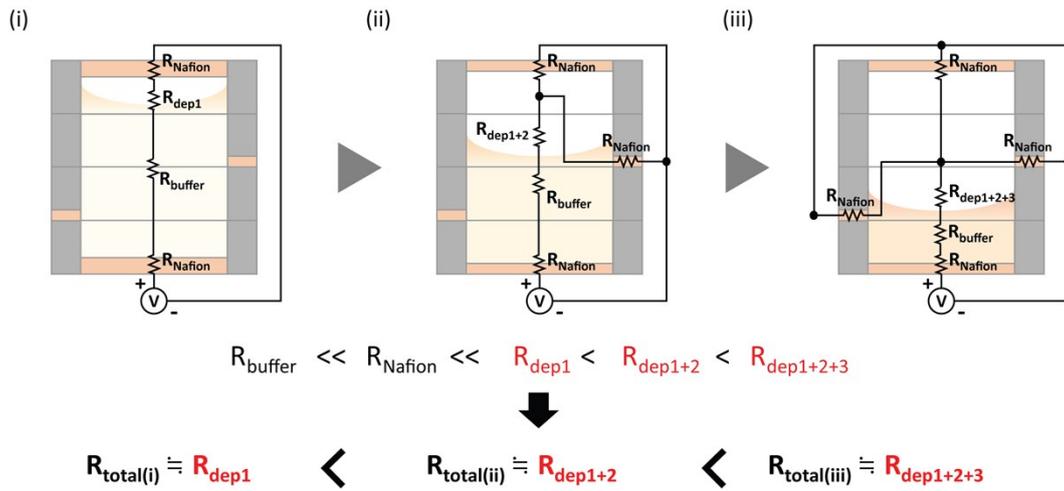
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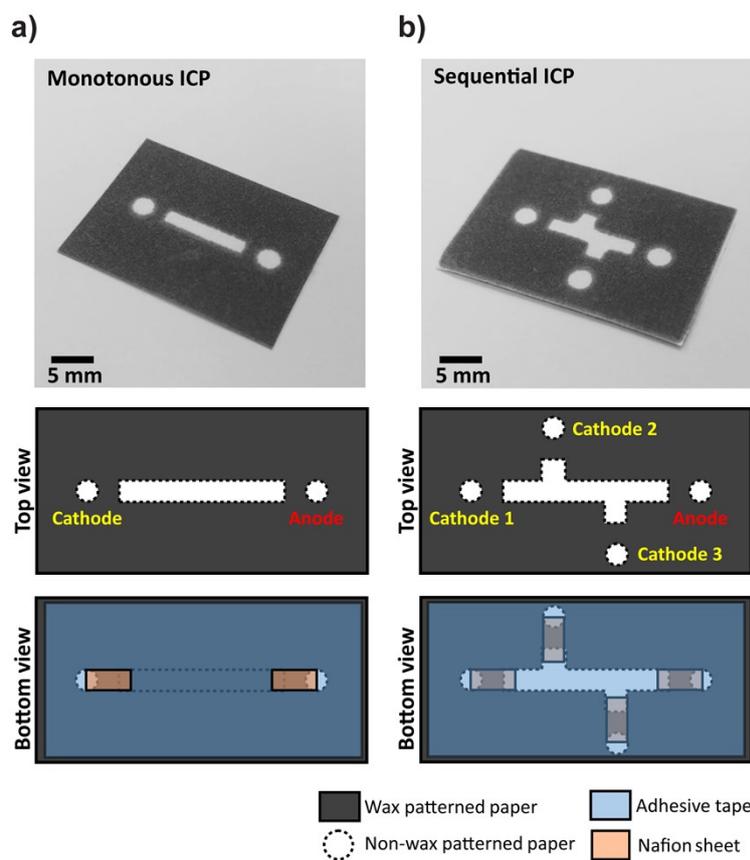
Supplementary Figure S1. Top and bottom view of the wax-patterning regions and Nafion positions in 3D seq-PAD.



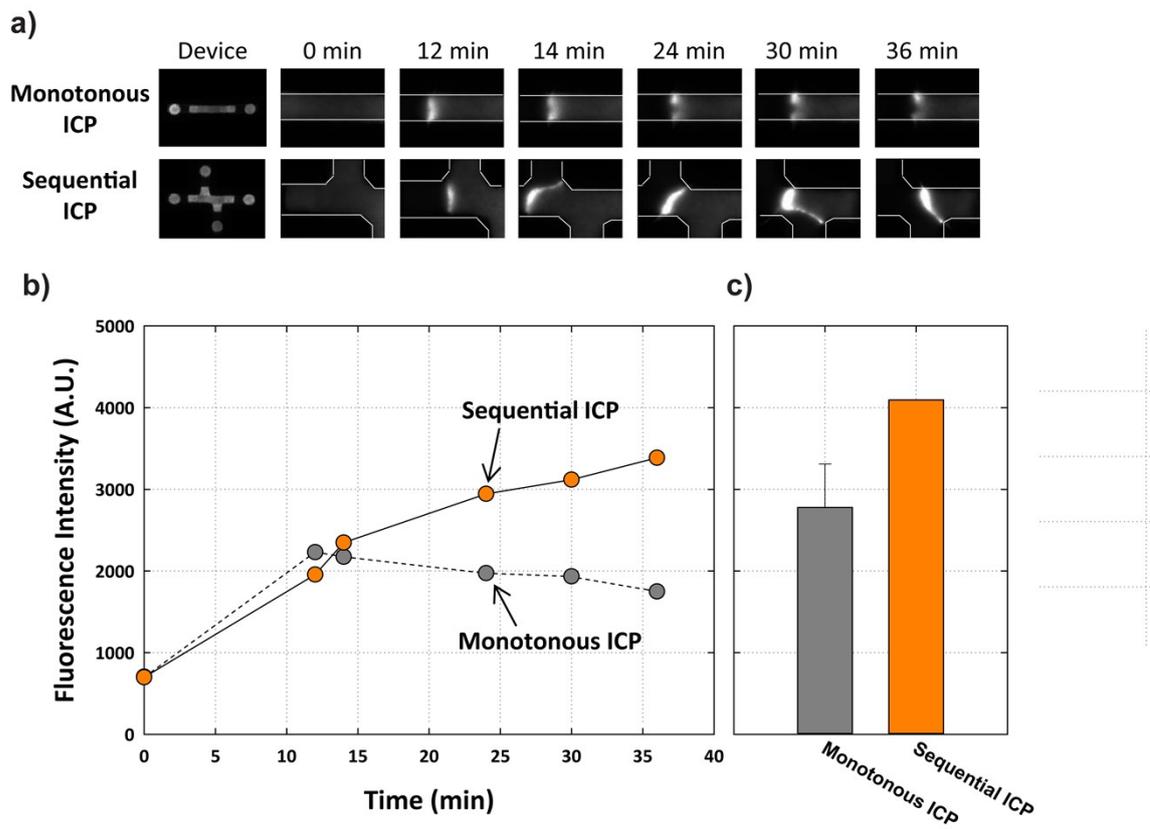
Supplementary Figure S2. Position of the anode and cathode reservoirs and the Nafion required for electrode contact and sequential ICP in top and bottom view. The anode and cathodes from 1 to 3 were used for sequential ICP and the test reservoir was used to check alignment of the four layers.



Supplementary Figure S3. Corresponding equivalent electrical circuit for operating steps. As the sequential ICP preconcentration progresses, the total resistance gradually increases. The ICP process generates the depletion region where no ions exist so that it results in the increase of the resistance. In addition, the depletion region becomes wider during the operation of the sequential ICP by our device, increasing the resistance even further.



Supplementary Figure S4. Optical and schematic images of the device for (a) monotonous ICP (m-PAD) and (b) sequential ICP (seq-PAD).



Supplementary Figure S5. Evaluation of sequential ICP preconcentration in 2D devices. (a) Fluorescence images and (b) intensity comparison between monotonous and sequential ICP over time. (c) Preconcentration factor of monotonous and sequential ICP preconcentration. The plotted data represents the average of fluorescence intensity with three independent experiments of multiple devices. The error bars represent the standard deviations.