**Supplementary Materials**

**Novel patterning methods using laminated or infused paper with Parafilm® for fabricating microfluidic paper-based analytical devices**

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**Movies**

**Movie S1**. A video shows an operation of the manual push-on valve fabricated by bonding of three patterned *i*-paper layers in a speed of 4X.

**Movie S2.** A video shows an operation of the time-gated fluid distributor fabricated by bonding of five patterned *i*-paper layers in a speed of 4X.

**Table**

**Table S1. Operation conditions of the CO2 laser (30 W, Zing 24) used in this work.**

|  |  |  |  |
| --- | --- | --- | --- |
|  | Ablation | Cutting | |
| *l*-paper | *i*-paper | paper (Chr. No. 1) |
| Resolution [dpi] | 1000 | 1000 | 1000 |
| Vector mode  power [%]  speed [%]  frequency [Hz] | 4  100  2,500 | 12  100  200 | 9  100  2,500 |
| Raster mode  power [%]  speed [%]  pattern type | 24  20  Stucki | None | None |

**Figures**



**Fig. S1.** A plot of measured channel widths as a function of the set value in a drawing for the sample shown in Fig. 3B. The average value and deviation were obtained from 18 measurements (6 samples × 3 positions).



**Fig. S2.** A plot of measured widths of (A) hollow channels in cut-out *i*-paper and (B) a cut paper channels as a function of the set value used in drawing.



**Fig. S3** Images of patterned *i*-paper layers used to fabricate μPADs of (A) a manual push-on valve and (B) a time-gated fluid distributor. The layer sizes were 20 × 30 mm2 for the valve device and 22 × 22 mm2 for the distributor. The gray color corresponds to *i*-paper while the white is chromatography no.1 paper. The 3rd time delay layer of (B) has four circular copy paper pieces (φ = 5 mm) with different wax-printed grid structures: the same line-to-line distance of 0.7 mm and different line thicknesses of 0, 0.1, 0.3, and 0.5 mm. The 4th sensing layer has four paper circles impregnated by differently colored dye solutions for the differentiation.