Electronic Supplementary Information

Optically Addressable Single-use Microfluidic Valves by Laser Printer Lithography

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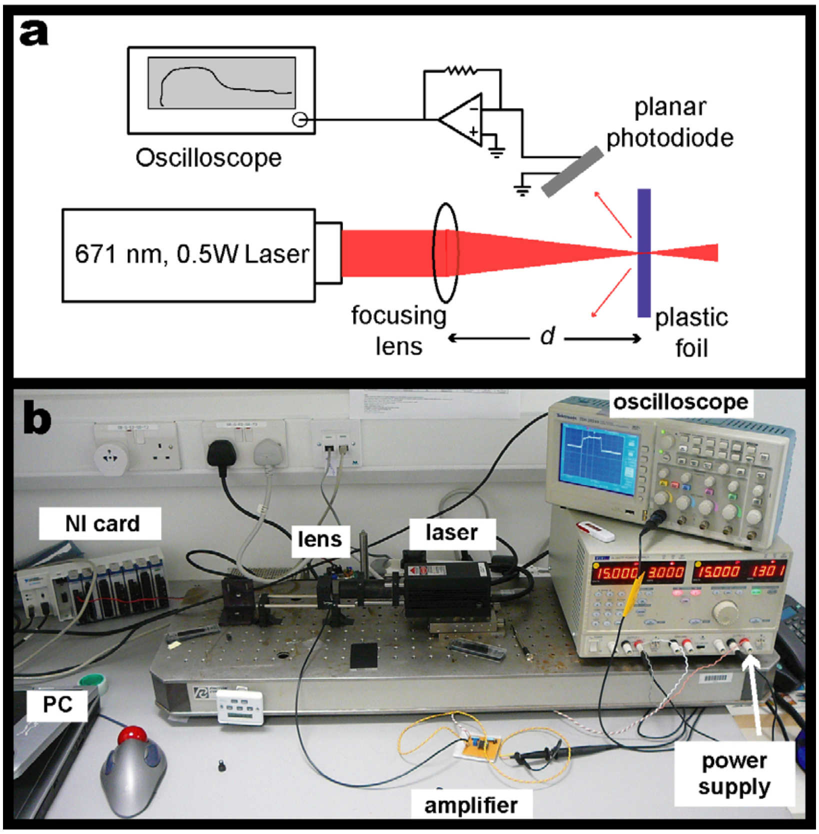
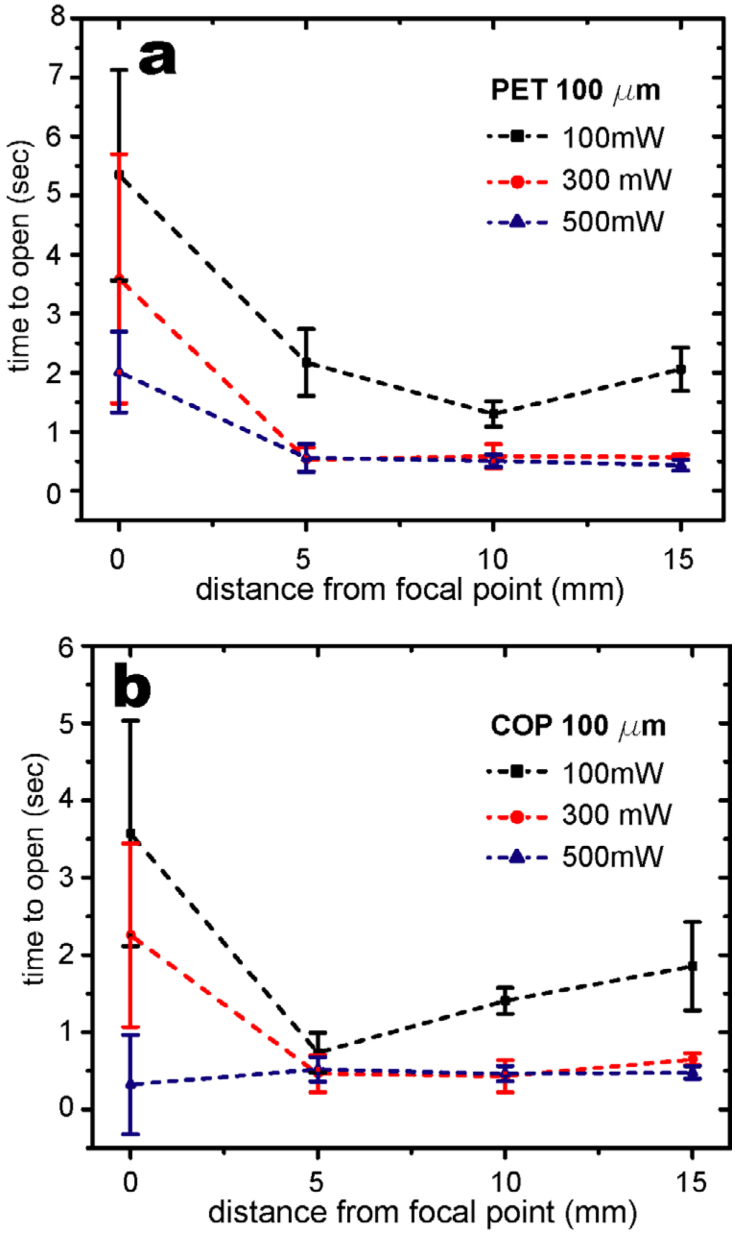
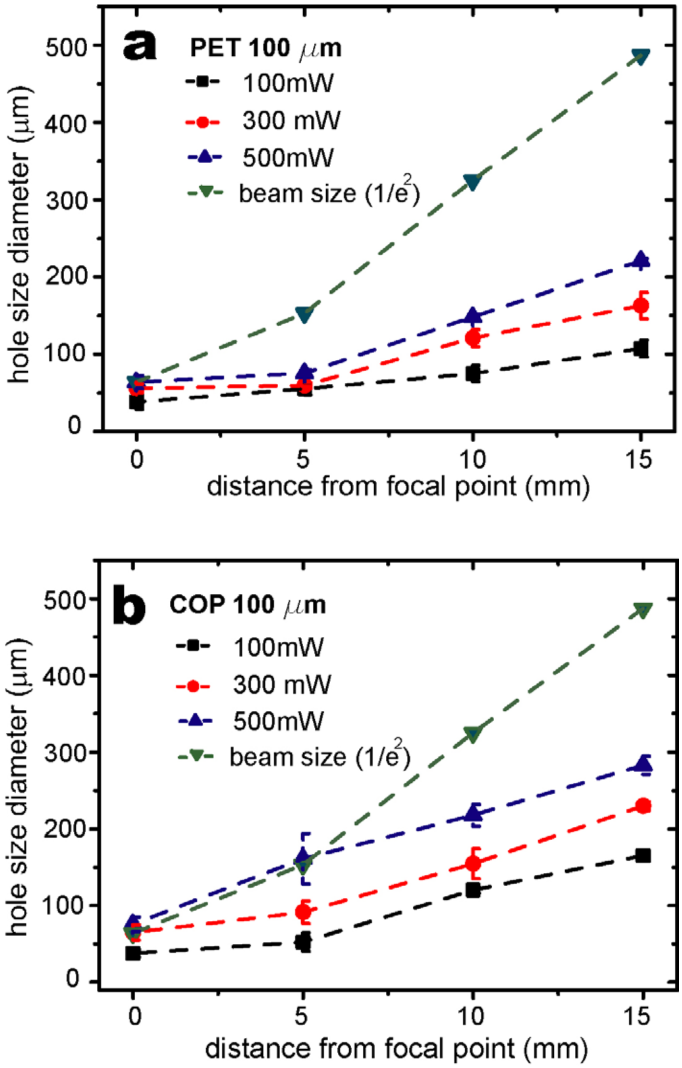


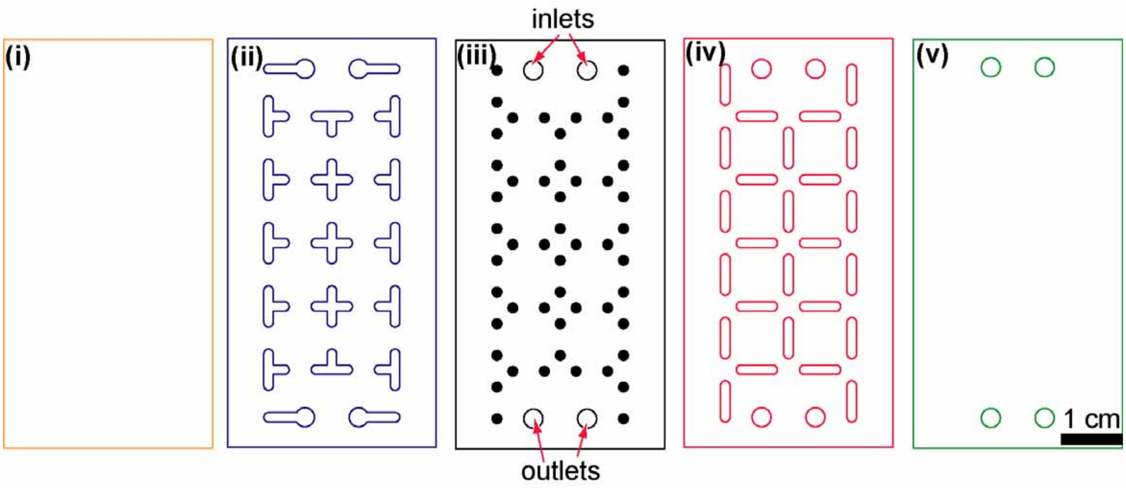
ESI_Figure 1. Schematic (a) and photograph (b) of the experimental setup. Light from a 671-nm solid-state laser system is focused onto a plastic foil with a lens. The distance *d* was varied to investigate the effect on the size of the orifice. Scattered light is measured using a planar photodiode connected to an oscilloscope through a transimpedance operational amplifier.



ESI_Figure 2. Valve response times. Results for 100-μm thick (a) PET and (b) COC substrates. Distance from the focal point, *d*, was varied from 0 to 15 mm. The opening time varied from 0.5 to 5.5 sec for PET, whereas for COC the time ranged from 0.25 to 3.5 sec.



ESI_Figure 3. Orifice size characterization on PET and COC substrates. The distance from the focal point, *d*, was varied from 0 to 15 mm. The laser valve orifice diameter varied from 30 µm to 225 µm for PET, whereas for COC the diameter ranged from 35 µm to 280 µm. The ray-tracing program TracePro (Lambda Research, USA) was employed to estimate the beam waist diameter at different distances from the focal point (achromatic lens, *f* = 60 mm, original laser beam diameter: 2 mm, beam divergence: 1 mrad). The beam diameter was defined where the intensity fell to $(1 - 1/e^2)$ of the maximum value (86% of the total beam energy).



ESI_Figure 4. CAD design of microfluidic device shown in Figure 6. The device consisted of 5 different laser-cut layers assembled by multi-layer lamination. The bottom substrate (i) consisted of a 500-µm thick layer of PMMA whereas the top substrate (v) consisted of a 1.2-mm thick PMMA layer. A laser printer was used to pattern dots on a PET substrate (iii). Inlets and outlets were manually cut in these layers. The microfluidic layer (ii) and the connecting microfluidic layer (iv) were composed of stacks of three layers: 50-µm double-sided PSA, 125-µm thick PC, and 50-µm double-sided PSA. Finally, the device was assembled by laminating these five layers together.