Supplementary Material (ESI) for Lab on a Chip

Electronic Supplementary Information for

Elastomeric membrane valves in a disc

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Supplementary Experimental Information

Fabrication processes

PDMS (Sylgard 184; Dow Corning, MI) and polycarbonate (PC) (I-Components Co., Ltd, Seongnam, Korea) were used as the top and the bottom layer of the disc, respectively. The top layer was fabricated by molding PDMS, which was made with 35g of PDMS and 3.5g of curing agent for 10:1 ratio, and cured on a 5 mm-thick PC master, which has been fabricated in a 60 mm-radius disc shape with 3 mm-diameter cavities at appropriate valve positions using a CNC milling machine (3D modeling machine; M&I CNC Lab, Osan, Korea). The elastomeric membrane was prepared by spin coating PDMS on a round shaped 1 mm-thick PC plate. The thickness of the membrane was adjusted by controlling the spin rate of the spin coater. The top layer of molded PDMS and the spin coated PDMS membrane have been cured enough for 120 min in the 65 degree dry oven. Then, cured top PDMS layer and PDMS membrane treated with 70 W oxygen plasma (Cute plasma system; Femto Science, Korea) for 50 seconds on each surfaces to be bonded. After plasma treatment of the top PDMS layer and the spin-coated PDMS membrane, the top layer was bonded onto the PDMS membrane as soon as possible – within 2 min after the oxygen plasma treatment. The bonding was carefully performed without trapped bubbles and the top layer with bonded PDMS membrane was peeled off. The holes for injecting fluids and ventilation were formed by punching

through the PDMS assembly. The bottom layer of the disc was fabricated by milling 5 mm-thick PC plate with a CNC milling machine. For irreversible bonding of the top PDMS and the bottom PC layers, a room temperature PDMS-thermoplastic bonding technique was utilized.[1] The 3 mm-diameter circular area for the valve, which should not be bonded but in contact with a membrane, was masked using a permanent marker (Namepen; Monami Co., Ltd, Yongin, Korea). The masked PC disc was treated with 60 W oxygen plasma for 60 s, and placed in an aqueous solution of 1% v/v 3-aminopropyltriethoxysilane (APTES) (Sigma-Aldrich Corp., MO) for 20 min at room temperature. Then, bottom PC layer was brought out of the APTES solution, and dried with nitrogen gas. After the surface treatment, the ink mask was entirely removed with isopropylalcohol (IPA). Finally, the top PDMS layer with the membrane was treated with 70 W oxygen plasma for 50 s, and bonded onto the APTES treated bottom PC layer. Because the bonding which was between top PDMS layer with membrane and APTES treated bottom PC layer have been bonded irreversibly and almost immediately, the bonding process was performed by placing one side to the other side slowly and carefully with alignment of valves and microchannels without bubbles, and by keeping in conformal contact at room temperature for a few minutes – 2 min was enough for bonding.

1. V. Sunkara, D.-K. Park, H. Hwang, R. Chantiwas, S. A. Soper and Y.-K. Cho, *Lab Chip*, 2011, DOI: 10.1039/C1030LC00272K.