A NOVEL BONDING METHOD FOR THE FABRICATION OF LARGE-SIZE AND HIGH-THROUGHPUT PDMS MICROFLUIDIC CHIP

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Advances in the microfabrication of microfluidic and biochip devices have made polydimethylsiloxane (PDMS) the material of choice for biomedical, analytical and biotechnological applications.[1-3] And a variety of bonding technologies have been developed to seal the micro-channels on PDMS. But, most technologies aim for small and single chip functions. It is still a challenge to investigate new technologies for large-size and high-throughput PDMS microfluidic chip fabrication.

This paper reports a new bonding method for large size PDMS-based microfluidic chip fabrication, which is based on display technology. The fabrication process combines a process of first polaroid bonding commonly used in liquid crystal display (LCD) manufacturing production and then thermal bonding. Polaroid bonding provides specific advantages to the large size microchip including good alignment and bubble free. Thermal bonding is applied to improve the bonding strength between PDMS and glass.

The microchannel design of the PDMS microfluidic chip is shown in Fig 1a. And Fig.1b is the photo of a large sized PDMS chip obtained by the new bonding method. Fig. 2a and 2b respectively shows the polaroid bonding machine used in this study and the schematic illustration of the machine's working principle. The bonding strength of the PDMS chip obtained by different method is shown in Fig. 3. Leakage tests are another method to assess the adhesion strength of the large size PDMS-glass microchip. Fig. 4 exhibits the results of the leak tests.The maximum pressure between PDMS and the glass substrate is 739 Kpa, which is comparable to interference-assisted thermal bonding method.[4] The new bonding method can also be used for 6×6 inch microchip bonding procedure. This provides an efficient method for manufacturing large size and high throughput PDMS microfluidic chip.

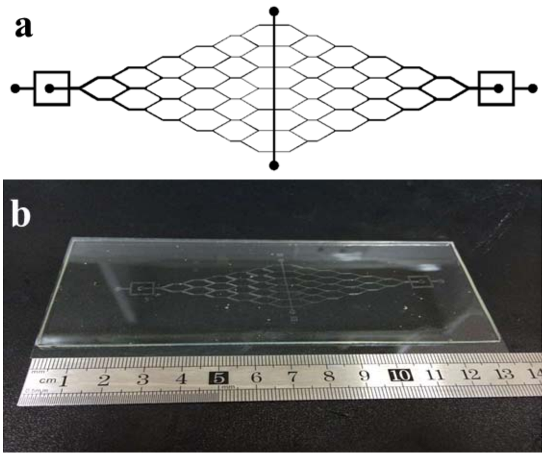

Fig.1 (a) the CAD drawing of the Y shaped microchannel and (b) photo of the fabricated chip.

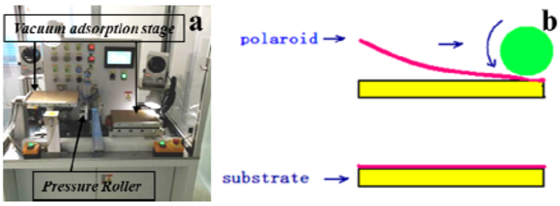

Fig.2 (a) the polaroid bonding machine used in this study and (b) the schematic illustration of the machine's working principle.

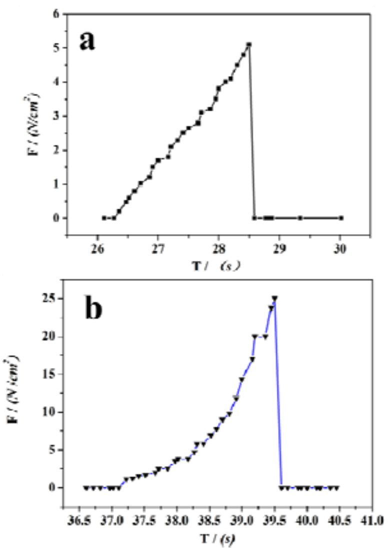

Fig.3 The adhesion force between PDMS and glass when PDMS-glass bonded (a) only by polaroid bonding, (d) by polaroid bonding and thermal bonding.

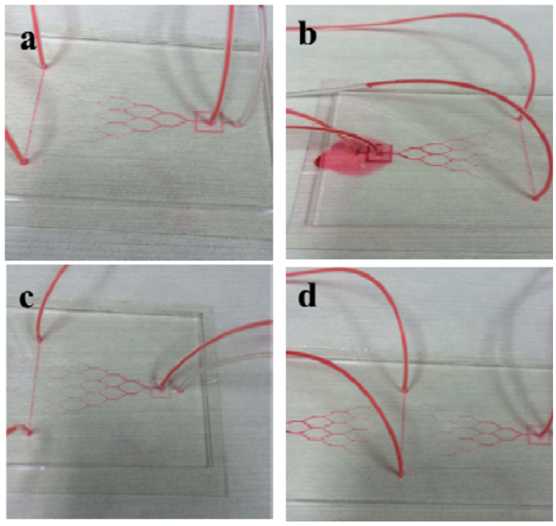

Fig.4 Leak test of PDMS chip bonding only by polaroid bonding (a, b) and polaroid bonding combined thermal bonding (c, d) at different flow rates: (a, c) 200 μL·h-1, (b) 250 μL·h-1, (d) 1000 μL·h-1.

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