

Normally Closed Thermoplastic Microfluidic Valves with Microstructured Valve Seats: A Strategy to Avoid Permanently Bonded Valves during Channel Sealing

Authors : Kebin Li, Keith Morton, Matthew Shiu, Karine Turcotte, Luke Lukic, Teodor Veres

Abstract : We present a normally closed thermoplastic microfluidic valve design that uses microstructured valve seats to locally prevent the membrane from bonding to the valve seat during microfluidic channel sealing. The microstructured valve seat reduces the adhesion force between the contact surfaces of the valve seat and the membrane locally, allowing valve open and close operations while simultaneously providing a permanent and robust bond elsewhere to cover and seal the microfluidic channel network. Dynamic valve operation including opening and closing times can be tuned by changing the valve seat diameter as well as the density of the microstructures on the valve seats. The influence of the microstructured valve seat on the general flow behavior through the microfluidic devices was also studied. A design window for the fabrication of valve structure is identified and discussed to minimize the fabrication complexity.

Keywords : hot-embossing, injection molding, microfabrication, microfluidics, microvalves, thermoplastic elastomer

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