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Wedge Actuated Normally-Open and Normally-Closed Valves for Centrifugal Microfluidic Applications

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Highlights

- Designed, fabricated, and test a new valving technology for both normally closed and normally open micro pinch-valves on a centrifugal platform;
- The valves can be used for lab-on-CD applications;
- Microfluidic components and channels were fabricated using soft lithography;
- Valves have simple structure, high reliability, and low cost.

Abstract

Normally-open valves are difficult to achieve and highly demanded in centrifugal microfluidic systems. This paper reports a novel pinch-type valving technology that can be used to realize both normally closed and normally open valves for fluidic control on centrifugal microfluidic platform. A sliding wedge with inclined surface planes was used to transduce the actuation of the centrifugal force from radial direction to the perpendicular direction of the microfluidic disc. The function of the valves has been demonstrated experimentally using a PDMS microfluidic system. The burst frequency of normally-closed valves can be tuned through changing the physical parameters of the valving system. The normally-open valve shows good performance at blocking the flow at high rotation speed and maintained blocking of the sample flow until the platform completely stops. The valving technology offers key advantages over current active valving techniques for Lab-on-CD, including simpler actuation process, less contamination to samples, better reversibility, and more effective in implementing of normally open valves.

Key Words: Normally-closed valve; normally-open valve; lab-on-CD; centrifugal;

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