BUILD AND TEST YOUR OWN INTEGRATED MICROFLUIDIC SYSTEMS USING A RECONFIGURABLE STICK-N-PLAY MODULAR MICROFLUIDIC SYSTEM KIT

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ACTIVITY

A reconfigurable "stick-n-play" modular microfluidic system kit is provided to build and test your own integrated microfluidic systems. The modular microfluidic system kit comprises seven serpentine channel modules, two straight channel modules, one 2-3 and one 3-4 fluid flow splitters, four inlet and four outlet modules, and a base platform.

WHY MODULAR DESIGN

Significant time, effort and expertise are required to develop a multi-function microfluidic system. A slight modification of the multi-function microfluidic system frequently requires rebuilding the entire microfluidic system, which will result in a long development time and incur substantial costs. Modular design approach or modular architecture is one of the proven approaches to address the integration problem.

HOW IT WORKS

Magnetic interconnects, comprising ring magnets and sealing gaskets, are integrated into each microfluidic module's inlet(s) and outlet(s) for both module-to-module and world-to-chip fluidic interconnects. The magnetic interconnects reversibly "stick" each individual microfluidic module together and provide a leak-free fluidic communication between connected microfluidic modules in order to form a larger integrated microfluidic system. Because of the magnetic interconnects, connected microfluidic modules can be easily disconnected, reconfigured and connected again to form a different integrated microfluidic system.

Magnetic interconnect design and assembly

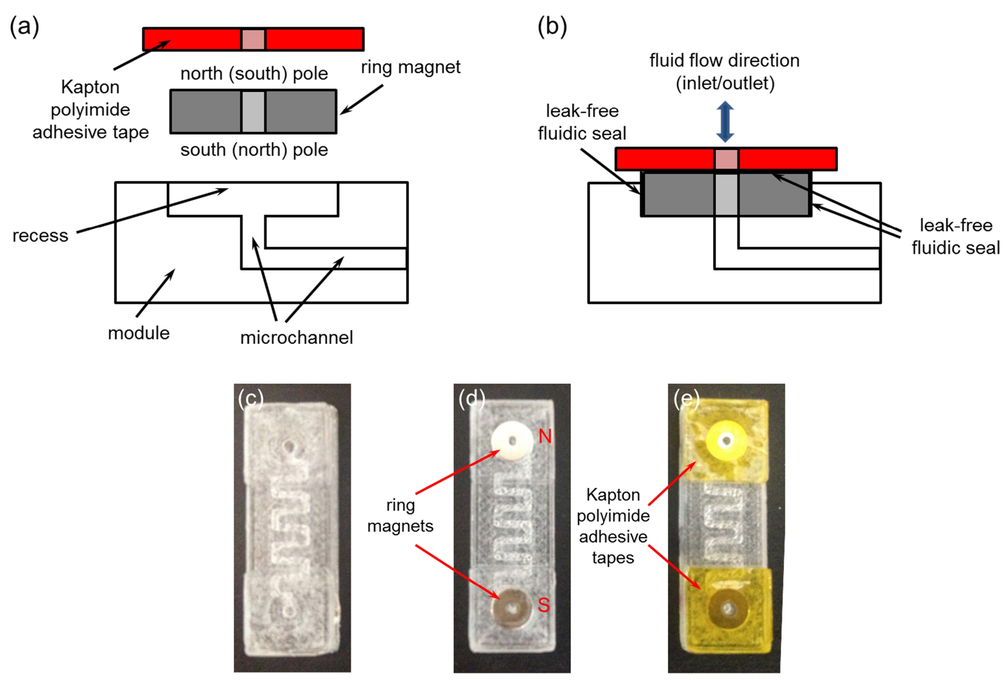

FIG. 1 *Cross-sectional side schematics of a magnetic interconnect (a) before and (b) after the ring magnet and the sealing gasket were assembled. (c) – (e) 3D printed serpentine channel module with two magnetic interconnects. (c) The serpentine channel was 1 mm x 1 mm and the two inlet/out recesses were 5 mm in diameter and 0.8 mm tall. (d) N52 5 mm OD × 1 mm ID × 1 mm thick nickel plated neodymium ring magnet was press-fitted and glued into each recess. (e) 2 mil (~50 μm) thick Kapton polyimide adhesive tape (10 mm × 10 mm with a 1.5 mm diameter center hole) was adhered on top of each ring magnet and the module.*

Reconfigurable stick-n-play modular microfluidic system kit

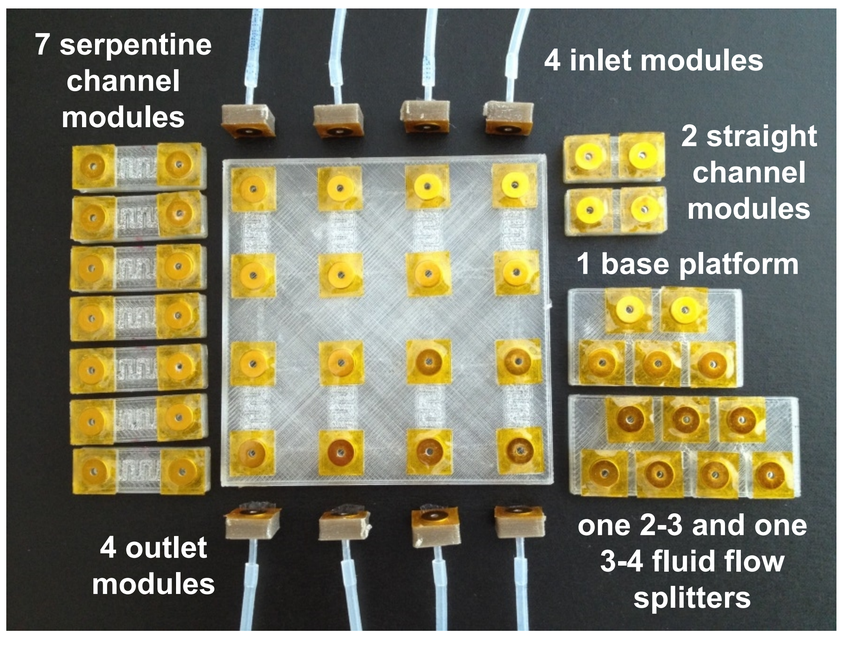

FIG. 2 *Reconfigurable stick-n-play modular microfluidic system kit comprises seven serpentine channel modules, two straight channel modules, one 2-3 and one 3-4 fluid flow splitters, four inlet and four outlet modules, and a base platform.*

Reconfigurable modular system examples

FIG. 3 *7-serpentine channel modular microfluidic system using seven serpentine channel modules and two inlet/outlet modules. N and S represent the north and the south poles of the ring magnets, respectively. Kapton polyimide adhesive tape was used as the sealing gasket. (a) Before and (b) after assembly of the modular microfluidic system. (c) Assembled modular microfluidic system was filled with a blue colored food dye solution. The white arrows indicate the fluid flow direction and the fluid flow rate was 100 μl/min.*

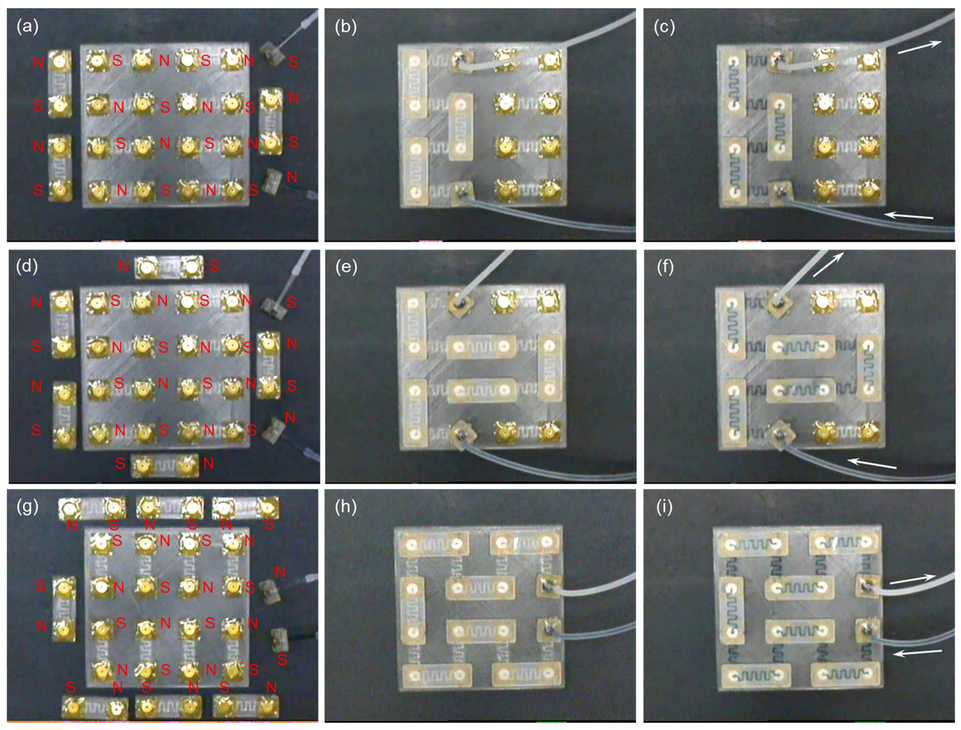

FIG. 4 *Three different configurations of a serpentine channel modular microfluidic system using (a) – (c) three, (d) – (f) five or (g) – (i) seven serpentine channel modules, two inlet/outlet modules and the serpentine channel base platform. N and S represent the north and the south poles of the ring magnets, respectively. Kapton polyimide adhesive tape was used as the sealing gasket. (a), (d) and (g) Before and (b), (e) and (h) after assembly of the modular microfluidic system. (c), (f) and (i) Assembled modular microfluidic system was filled with a blue colored food dye solution. The white arrows indicate the fluid flow direction and the fluid flow rate was 100 μl/min.*

WANT TO KNOW MORE?

1. **Outreach event for the public**
2. **Late News poster presentation**

   M217j A reconfigurable stick-n-play modular microfluidic system using magnetic interconnects (P. K. Yuen)

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