MICROFLUIDICS

Microfluidics for the people

A simple approach for making multilayer microfluidic devices should make this technology more accessible to biologists.

Many interesting applications of microfluidic technology have been developed, but microfluidic devices are not yet standard equipment found in most biologists' toolboxes. "Just one of the obstacles in the way is the difficulty of making them," says David Piston of Vanderbilt University. Making polydimethylsiloxane (PDMS) microfluidic devices via soft lithography requires using a clean room, and as Piston comments, "nothing will scare off a biologist faster than that."

Piston's group has been using microfluidic devices for cell imaging experiments for some time now, but they found the typical soft lithography approach to be painfully slow and difficult. They wanted to create a device to monitor insulin secretion from pancreatic islets, but they needed a method that would allow rapid prototyping of different device designs. Even though (unlike many labs) they had access to a clean room, they were also frustrated that the silicon masters used in soft lithography broke easily.

So, they developed a new approach to making microfluidic devices that they call "toner transfer masking," no clean room necessary. In this method, a toner pattern is laser printed onto photographic paper and the pattern is transferred to a brass substrate by applying heat. The blank regions of the brass are chemically etched away; PDMS is then poured over the brass master and allowed to cure, and then it is peeled off and bonded to glass or a flat piece of cured PDMS. Importantly, the brass masters are unbreakable, allowing them to be reused again and again. Multilayer devices, even ones incorporating pneumatic valves, can be made by using different brass masters and bonding the PDMS layers to each other.

The quality of devices made by this method approaches that of devices made by traditional soft lithography, "as long as you don't want to make 50-micron or smaller channels," explains Piston. The researchers have made water-in-oil droplet-generating devices, as well as devices for cell trapping and imaging.

Though Piston acknowledges that many biologists are unlikely to take advantage of microfluidics unless they can buy the devices, he hopes that their simplified approach will make the technology more accessible to a larger number of researchers. "If you can do it on a corner of a bench, a lot of people will find a way to do it," he says.

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RESEARCH PAPERS

Easley, C.J. *et al.* Rapid and inexpensive fabrication of polymeric microfluidic devices via toner transfer masking. *Lab Chip*, published online 19 January 2009.