Low-cost microfluidics can be a sticky problem

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A deceptively simple approach to bonding thermoplastic microchannel plates together with solvent could be used for low-cost, high-volume production of disposable "lab-on-a-chip" devices, according to researchers from the National Institute of Standards and Technology (NIST) and George Mason University (GMU).

Microfluidics is considered a highly promising technology for performing rapid and inexpensive chemical and biochemical analyses. The defining feature of microfluidics is the use of tiny channels less than a fraction of a millimeter wide to move samples and reagents through the device. For high-volume production, the channels likely will be molded or embossed in high-quality thermoplastic and then sealed with a cover plate. Bonding the two pieces together securely without blocking or altering the tiny channels is a key manufacturing issue.

One approach is to weld the two plates together by clamping them and heating the plastic to the point where the polymer chains begin to diffuse together. This requires just the right combination of time, pressure and temperature--which unfortunately has to be fine-tuned for each new lot of plastic. The other method is to weld the pieces with a solvent-type glue, like a model plane, but as model-builders will appreciate, the problem is keeping the glue where you want it and away from where you don't want it.

In a recent paper in Analytical Chemistry, a team from NIST and GMU suggest that the answer is simple: use the channels. They clamp the two

plates together, inject a tiny amount of solvent at one end of the network of channels and apply vacuum at the other end. As the solvent is sucked through the channels, too fast to clog them, a minute amount is drawn between the plates by capillary action and welds them together. Total welding and incubating time: about 8 minutes. To demonstrate utility, the team successfully performed high-efficiency electrophoretic separation of 400-base single-strand DNA ladders, a typical microfluidics application, in the devices fabricated using the technique.

Citation: J.J. Shah, et. al., Capillarity induced solvent-actuated bonding of polymeric microfluidic devices, *Analytical Chemistry* 2006; 78(10) pp 3348 - 3353.

Source: NIST