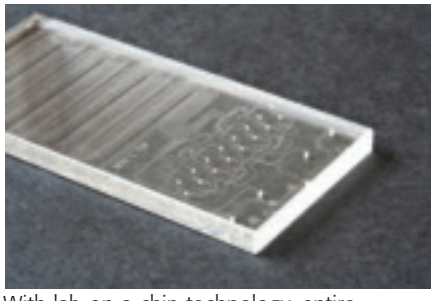
(continued from page 6)
possibility to massively improve the performance and throughput of our devices, e.g., our droplet generation chip and our reactor chips. We now have the potential to create a chip that could produce in excess of 32,000 droplets per second." The developments are especially pertinent for drug development and drug discovery industries, he added.

The fabrication processes used to create a microfluidic device have some similarity to those used in the electronics industry. The channels through which the fluids flow and interact are etched into materials such as glass or polymers using similar photolithography processes, for example. The patterned layers are then aligned, fused and drilled to provide microscopic ports through which the chemical or gases can leave the device.



With lab-on-a-chip technology, entire complex chemical or biological management and analysis systems are created in a microfluidic chip.

Indiana firm pioneers new metalcutting procedure

M4 Sciences, West Lafayette, Ind., has developed a metalcutting process for micro- and macro-scale machining that offers a variety of benefits, including:

- improved chip breaking;
- easier chip disposal;
- reduced energy consumption and friction at the tool-chip interface, thereby reducing tool wear; and
- fewer burrs, which eliminates secondary deburring operations.

It's called Modulation-Assisted Machining, and it involves superimposing a controlled, low-frequency modulation on the metalcutting process, according to the company. The frequency typically is around 1,000 Hz with amplitudes up to 500µm. The controlled modulation can be applied to the cutting tool or to both the tool and workpiece.

M4 developed the process specifically for applications involving difficult-to-machine materials, such as titanium, tantalum and stainless steel, that cause excessive tool wear.

The company reported that analysis, "has shown that the principal benefits are a consequence of perturbation of the chip-formation process and the tool/chip contact conditions resulting from the superimposed modulation. Chip breakage in machining processes (e.g., turning, boring, drilling) was found to be a consequence of the chip thickness reaching zero during each cycle of modulation under the "right" modulation conditions. Furthermore, these conditions could be predicted a priori as a function of the machining parameters using a simple model."

M4 is currently developing an "ultra-precise" electromechanical attachment for CNC Swiss-type lathes. Called TriboMAM, it's designed for small-diameter, deep-hole drilling from 0.100mm to 5.0mm in diameter, with length-to-diameter ratios of 10:1 to 100:1. The company said that TriboMAM can raise productivity fivefold in applications involving stainless steel, titanium and tantalum.

A lead-zirconate titanate piezoelectric actuator vibrates the drill up to 1,000 Hz with up to 200µm amplitude. TriboMAM replaces cylindrical toolholders, is designed for through-coolant applications and accommodates a standard ER-8 collet. Controls are external and don't require the user to modify the machine tool.