Key Developments in Microfluidics and µTAS Place Lab-On-A-Chip on the Fast Track to Commercialization

September 18 2004

Constant innovation in the field of microfluidics and µTAS has enabled lab-on-a-chip (LOC) technologies to successfully enter the mainstream commercial market.

LOCs are ready to make their mark in diverse areas such as high-throughput screening of drug candidates, point-of-care testing, and bioinformatics among several other possibilities.

”There are many reasons why LOCs score over traditional methods of analysis,” explains Technical Insights Research Analyst Katherine Austin. “While conventional laboratory analysis is time consuming, tedious, and requires expensive equipment and highly trained personnel, bench-top analysis in LOCs can be several times cheaper and faster.”

Other advantages of portability, rapid assay times, and smaller sample requirements are likely to accelerate the adoption of LOC technology, especially in the defense and public health sectors.

The drug discovery sector has also become a major target for LOC vendors, as it is a large-scale and highly automated sector. Pharmaceutical companies are aiming for reduced sample volumes in order to cut back on reagent costs, which in turn drive demand for LOCs that offer precision, flexibility, and ease of use.

To further the penetration of LOCs into commercial applications, microfluidics and micro total analytical systems (μTAS) must incorporate certain key elements in the LOC design. For instance, microseparations are required for the reliable operation of analytical LOCs – particularly those working on whole samples such as blood and urine.

Fast and versatile optical sensing is often the analytical mode of choice for LOCs. Optical sensing is not only a time-tested technique outside the LOC arena, but its broad spectrum of light – from ultraviolet to infrared – can also target specific events or chemical interactions.

Recent developments in microfluidics show that the more affordable plastics/polymers are gaining popularity over their more expensive counterparts such as glass and silicon micromachining.

“LOC developers have learned to work with plastics by applying surface modifications or coatings, and manipulating polymer chemistry so that the initial compatibility issues have been, for the most part, solved,” asserts Austin.

A large part of the commercial manufacturing process of LOCs focuses on disposable chips, cards, or discs that are produced by inexpensive injection molding. These LOCs are easier to manufacture and facilitate the development of lower priced, more rugged, and flexible electronic devices.

The prolific growth of plastics/polymers along with technological advances in microelectromechanical systems (MEMS), semiconductor microfabrication methods, biosensors, and biomedical engineering expects to have a positive impact on the commercialization of LOC.

However, many LOC researchers have lost sight of the bigger picture

and actual market needs due to their constant bid to improve the design mechanics for microfluidics and μTAS. In this context, appropriate target and niche marketing could be crucial to gain long-term commercial success.

For example, many target customers have already installed expensive dispensers and high-throughput screening. Hence, the market for LOC microfluidic systems is likely to be limited, unless the technology demonstrates sufficient benefits to justify the additional investment.

The good news is that the timing is perfect to stretch the limits of microfluidics and μTAS for LOC development. At this point, almost anything can be embedded into an active microfluidics LOC, including sensors, filtration membranes, optics, digital readouts, and global positioning system chips.

Scientists are also trying to increase the modularity of microfluidic and mTAS components to facilitate the use of LOCs in multiple applications. In fact, enzymatic reactions, filtration, and electrospray ionization are frequently incorporated onto the same chip.

“In order to cater to the increasing demands of the market, microfluidic and μTAS LOCs are becoming more open and modular, both in terms of combining multiple chips and integrating chips with existing laboratory instrumentation and equipment,” concludes Austin.

Technical Insights is an international technology analysis business that produces a variety of technical news alerts, newsletters, and research services.

Emerging Technologies in Lab-on-a-Chip: Microfluidics and μTAS is part of the semiconductor vertical subscription service, and examines the latest advances in microfluidic and μTAS LOC technologies that are

likely to enable LOCs to move from the laboratory into the commercial world. Apart from key technology drivers, evaluation of the challenges facing LOC technologies is also provided. Executive summaries and interviews are available to the press.

Source: Technical Insights