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Advances in Ion Beam Micromachining for complex 3D Microfluidics

Abstract

The focused ion beam / scanning electron microscope (FIB/SEM) is a powerful tool used for sample analysis and characterization. When equipped with a sophisticated pattern generator and lithography technology it can expand its use to new applications in nano- and micro-fabrication. Ion beam micromachining is akin to electron beam lithography, where the beam of charged particles are steered to draw structures contained in a computer aid design (CAD) file. Unlike electron beam lithography, one can program arbitrary depths by manipulating the dwell time, or dose, of a particular structure. We have been working on this topic for several years now and are able to show that the ion beam tool can be used for real microfluidic applications where the bottom of serpentine mixers are texturized dramatically using the FIB/SEM. Some of the lessons learned and pros and cons of different patterning strategies will be presented.

Bio

Dr. Ocola is a staff scientist in the Center for Nanoscale Materials Division at Argonne National Laboratory since 2002. He received his B.Sc. from the Universidad Nacional de Ingenieria (Lima, Peru) in 1988, his M.Sc. from the University of Wisconsin-Madison in 1991 and his Ph.D. from the University of Wisconsin-Madison in 1996, in physics. Dr. Ocola joined Argonne National Laboratory in 2002 where he was involved with the design, construction and instrumentation procurement of a new DOE funded nanocenter. He currently is involved in nanofabrication research at the CNM. Dr. Ocola has published over 90 papers, and 1 book and holds two patents. His research interests include electron beam lithography and simulating high-energy electron beam interactions with polymer materials, scanning probe characterization techniques, FTIR micro-spectroscopy, single molecule spectroscopy, nanofluidic devices and nano-photonics.