

Tech Brief: September 2005

Micragem™ - Standardized MEMS Manufacturing Process

As a full-service MEMS foundry, Micralyne is examining ways of improving MEMS product development. One key issue companies are facing is time-to-market – how long it takes to move a MEMS-based product from an idea to generating revenues.

Developing a product based on Micragem™ reduces time-to-market by taking advantage of Micralyne's existing processing capabilities.

Micragem™ is an SOI-based MEMS fabrication process with a set of design and process guidelines that can be used by companies to manufacture a number of different types of MEMS components in a standardized fashion.

An emerging technology in the fabrication of MEMS devices is silicon-on-insulator (SOI) substrates. SOI technology was originally developed to avoid charge leakage in pn junctions, but due to the robustness of the single crystal device layer as a structural material for silicon microstructures SOI substrates are attractive to MEMS applications. Micralyne developed Micragem™ as a standard process on SOI that is simple, versatile, and mature.

At the basic level, Micragem™ is a four-mask lithography process. Depending on the level of customization required, more layers could be added to increase versatility. The four-mask basic process remains quite powerful. The starting point is a 500 µm thick glass wafer. Mask 1 is used to pattern the glass for the first etch. This etch can be used to define cavities, gaps, microfluidic channels, grooves for electrode lines, etc. The glass is etched isotropically using a wet etch up to a maximum depth of 100 µm.

The substrate is then lithographically patterned with Mask 2 for metallization. This mask is used to define actuation electrodes, metal lines, and bonding pads. The deposited metal is typically gold, however other metals can be used. An SOI wafer is anodically bonded device side down, to the patterned side of the glass wafer. The thickness of the SOI wafer generally varies from 10-100µm, depending on the designer's requirements.

The handle and buried oxide portions of the wafer are etched away in a wet process, leaving a single crystal silicon membrane over the entire glass surface. Micralyne's proprietary low stress gold is deposited on the silicon surface, and lithographically patterned with Mask 3. The metal is then etched to expose the silicon using a wet etch process.

Next, Mask 4 is used for the final etch in the DRIE (Deep Reactive Ion Etch) tool, where the structures are released in a dry plasma, eliminating stiction problems. In the end we are left with a reliable, robust, and manufacturable MEMS device.



The potential of this process technology in the MEMS field is substantial. The process is well suited to manufacture miniaturized micro-mirrors, diaphragms, beams and valves for a variety of applications. For a visual representation of the Micragem™ process please [click here](#).

Micralyne has generated millions of dollars of revenue based on the Micragem™ platform and will be formally launching Micragem™ to the greater commercial market in the coming months. If you would like to receive further information about this standard MEMS process, please contact Micralyne at (780) 431-4400 or by [email](#).