MEMGEN'S AUTOMATED MACHINE USES METAL LAYERS TO BUILD 3-D MEMS

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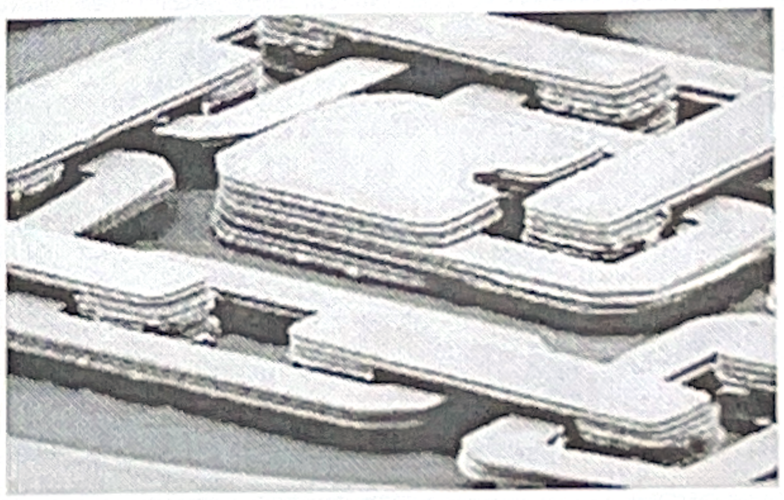
TORRANCE, Calif. -- MEMGen is gearing up to unveil a new fabrication process that could standardize part of the small tech industry, eliminate the need for clean rooms and reduce the skill level required to design microsystems.

The Torrance, Calif.-based company is touting their EFAB technology that uses a variety of metals and materials, other than silicon, and involves a fully automated machine that does the whole job of fabricating microdevices.



12-layer micro-chain with independently-movable links, fabricated in nickel in a single process using EFAB.

"The MEMS industry has been developing the silicon-based process for decades, so that process is very mature," said Warren Packard, a managing director at Draper Fisher Jurvetson, one of seven investors that recently funded MEMGen with a total of $11.3 million.

"MEMGen is pursuing other processes that will be complimentary to existing silicon-based processes. It's definitely a market expansion technology."

About the size of two refrigerators, the EFAB machine performs a new type of selective electroplating process, and it cuts fabrication time. Technicians can insert into the machine design plans, a substrate such as metal, and a mask that is similar to a printing plate.

The machine is turned on and layers of material are deposited in certain areas, using a technique resembling printing. When the EFAB machine is finished depositing the material, the sacrificial material -- which is commonly another metal used as temporary scaffolding-- is removed by etching.

Polishing is done and viola! You have a micromechanical device.

"Right now we are just doing it with microsystems that do not include electronic parts," said Adam Cohen president and CEO of MEMGen. "If you want a device with transistors and other electronic parts you'd start with that on a substrate and the EFAB machine would add the mechanical parts -- we haven't done it yet," said Cohen, who expects the technology to be ready by next year.

MEMS devices are traditionally limited to about five layers of silicon so it is difficult to achieve many functions and applications. Conversely, the EFAB machine can deposit hundreds, even thousands, of layers of metal to produce true three-dimensional devices that will do things that other MEMS devices could not do, said Cohen.

"If you wanted to make a microsurgical instrument to go on the end of an endoscope for

minimally invasive surgery you need a 3-D structure or shape. Previous microfab processes couldn't produce a broad range of 3-D structures. To achieve the desired functionality, you need complex shapes in the macro world; the same is true in the MEMS world," he said.

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MEMGen holds the worldwide exclusive license for the EFAB technology that was developed and patented at the University of Southern California where Cohen led the research and development team. In the last month, the company doubled in size from seven to 14 employees and has plans to hire 35 new engineers and managers within a year.

Although the technology requires specialized knowledge, Cohen said that a typical mechanical engineer with a conventional mechanical engineering background could learn how to use the EFAB process within a few days. Using computer-aided design, an engineer could plan a microdevice in much the same way he or she would design an macroscale object in 3-D.

"This technique makes it possible for someone with minimal additional training to design devices that can be built," said Cohen. "They still will probably need additional training to design devices that function as intended.

"The norm in MEMS is that you design the device and a custom process to make the device -- there is no versatile standard process to make these things," Cohen said. "That's the killer. For every new design there is a new manufacturing process.

"We're saying it should be possible that you don't have to reinvent the manufacturing process. When MEMS manufacturing technology can become standardized it will be poised to grow at a much higher rate."

"The concept is extremely aggressive," said Jay Desch, an engineer at Honeywell Federal Manufacturing and Technologies in Kansas City, Mo., "to be able to do all that and eliminate all the technical obstacles."

Last year, Honeywell previewed the technology for electromechanical parts that could be used as part of a retrofit program to enhance safety and reliability in nuclear weapons for the U.S. government. Desch said he was concerned that the high number of layers could increase the chance of alignment inaccuracies and possible failure with the product.

Nevertheless, Desch said that the potential for the technology is very high and Honeywell is considering it for several applications when MEMGen begins accepting orders later this year.

BioVentures a biotech manufacturing company in Murfreesboro, Tenn., also checked out the EFAB technology with the hopes that it would allow them to create pipette devices that would reliability transfer expensive chemicals in amounts as low as picoliters, or one-trillionth of a liter.

"MEMGen would enable someone to create microstructures for lower costs because you don't have the overhead that the larger foundries have; it doesn't require the clean room expense," said John Steward chief engineer at BioVentures. "And the structures he's able to build, depending on your applications, will be superior to what some of the current MEMS can do."

Later this year, MEMGen expects to offer their new technology as a foundry service. "People can send their MEMS designs and they'll get back a device," said Cohen. The startup company plans to ramp up from prototypes to mass production by late 2003.