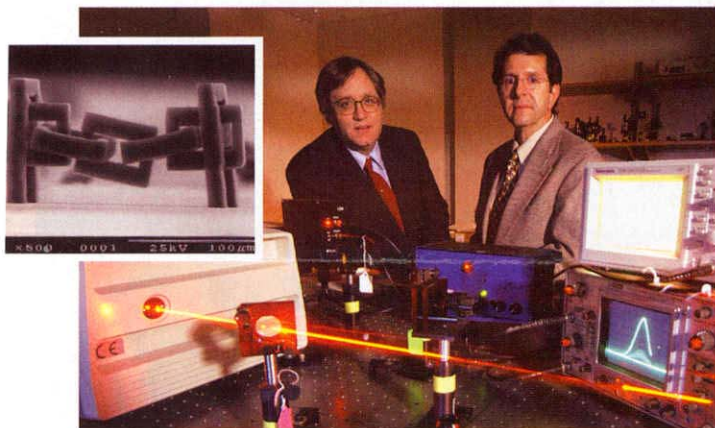


BY JOHN TERESKO

## 3-D Chemistry Builds Complex Micro-Structures

TRY IT FOR COMPLEX STRUCTURES THAT WOULD BE DIFFICULT TO BUILD LAYER-BY-LAYER WITH 2-D LITHOGRAPHIC PROCESSES.



Researchers Marder and Perry (right) fabricated the 3-D microchain. Links are not directly anchored to the surface.

**W**E BELIEVE THIS TECHNIQUE PROVIDES a real competitive advantage for making complicated 3-D microstructures." That's Georgia Institute of Technology Researcher **Seth Marder** (at the left) describing what he terms "a disruptive platform technology that we believe will provide broad new capabilities."

Marder, also a professor at Georgia Tech's School of Chemistry and Biochemistry, says the technique could compete with existing processes for fabricating many microfluidic devices. He also cites such things as photonic bandgap structures, optical storage devices, photonic switches and couplers, sensors, actuators, micromachines—even scaffolds for growing living tissues.

The unique 3-D microfabrication technique uses a special class of light-activated molecules to selectively initiate chemical reactions with polymer and other materi-

als. The result: complex structures with sub-micron features. Also demonstrated: the fabrication of tiny silver wires from patterns written in materials containing silver nanoparticles and ions.

The researchers believe that for 3-D microstructures, the simple two-photon technique could compete with complex multi-step fabrication processes that use lithography, etching and layering technologies borrowed from the microelec-

tronics industry. However, at the moment, the two-photon technique can produce only one structure at a time, while microelectronics-based processes simultaneously generate hundreds or thousands of identical structures.

Right now, that makes the new system more suitable for adding specialized 3-D structures to microsystems, prototyping new structures or making molds than for produc-

ing entire systems, notes researcher Joseph Perry, also a professor in the School of Chemistry and Biochemistry. Producing each structure now requires about 25 seconds, but increases in speed could make mass production feasible.

"We are working to integrate the technologies and develop a system that should be able to operate at a thousand times the throughput of the current system," he adds. "A single 3-D fabrication system should be able to generate about a million individual device structures per day. With a production facility using a number of fabrication systems, there is potential for certain types of mass production."

The researchers envision tabletop fabrication machines that would use a computer-generated design system to laser write the desired structure. A cartridge containing the polymer film would then be removed for chemical development. **IW**

## New Automation Via Fluid Analysis Software

With the trend toward mass customization, physical prototyping and testing issues loom larger—more product variations but less time to do the analysis.

Virtual prototyping and testing via software has given some relief. For example, fluid analysis software is now so easy to use that designers can easily peek inside proposed product configurations to spot and solve potentially troublesome flow problems. **More Good News:** Substantial new value has been added to the latest release of the computational fluid dynamics software from Blue Ridge Numerics Inc., Charlottesville, Va. Version 7 of CFdesign has the potential to greatly minimize the physical prototyping and testing of such things as pumps, fans, blowers, compressors, turbomachinery, electronics systems, valves and pistons.

With its new Solid Motion Module, Version 7 brings its considerable analytical power to the interaction between the mechanical parts in a fluid system and the fluid itself. Through simulation, the module allows understanding the interaction between fluids and

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