Chemical & Engineering News

Latest News

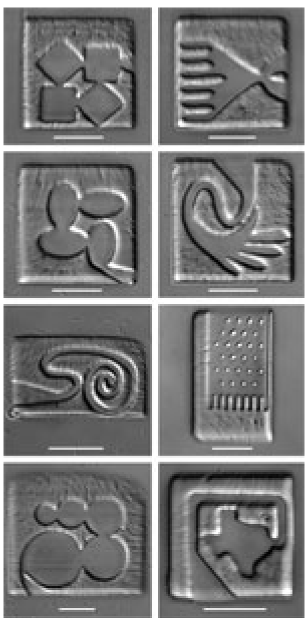
February 7, 2007

Microfabrication

Pick A Shape, Any Shape

Mask-based lithography method allows researchers to make arbitrary 3-D shapes

Celia Henry Arnaud



J. Am. Chem. Soc.

VARIETY Mask-based multiphoton lithography generates numerous shapes (scale bars = 15 µm).

Using a mask-based approach, chemists at the University of Texas, Austin, can rapidly fabricate whatever shap they want through multiphoton photolithography. Creating a new object takes less than 10 minutes from the original conception to the completed object, thereby making rapid prototyping possible. Grad student Bryan Kae and associate professor Jason B. Shear fabricate micrometer-scale objects with shapes ranging from a commo house fly to the state of Texas to a two-story "house" with tunnels for trapping bacteria (*J. Am. Chem. Soc.,* DOI 10.1021/ja068390y).

"Two-photon lithography is extremely powerful because it enables the formation of unusual three-dimensional micro- and nanostructures that would be difficult or impossible to fabricate using other methods," says John A. Rogers, a materials science professor at the University of Illinois, Urbana-Champaign. Rogers has also develop a mask-based approach to two-photon lithography that allows the formation of 3-D lattices in a single exposure step (*Opt. Express* **2006,** *14,* 2300). "Shear shows structure geometries that are different than and complementary to ours," he says. The two groups use different types of masks, Rogers says.

Shear's method requires more than a single exposure step, but it leads to a wider variety of shapes. Shear and Kaehr fabricate objects by focusing a laser beam through a confocal microscope to a tiny spot in a reagent solution, where the light promotes the cross-linking of proteins.

The researchers can direct the fabrication of objects with masks that they place in the path of the laser beam. They scan the laser beam in a raster pattern across the mask; cross-linking doesn't occur at the spots where the mask blocks the light. To create 3-D objects, they adjust the fine focus of the microscope and scan sequential planes.

Shear and Kaehr hope to use this technique to create 3-D replicas of biological materials. By making masks based on a series of confocal images and then stepping through the focal planes of the microscope for each nev mask, they should be able to fabricate a replica of the original tissue. For instance, they hope to make replicas o extracellular matrix that they can use to grow neurons.

Chemical & Engineering News
ISSN 0009-2347