May 22, 2006

Fabricating three dimensional nanostructures using two photon lithography in step

(*Nanowerk Spotlight*) New research shows that soft, conformable sub-wavelength ph used, with 2-photon effects, to pattern in a parallel fashion and in a single exposure s structures in certain classes of photopolymers. The result is a technique that is simpl experimental standpoint, but which fully exploits the flexibility and patterning capabili photon effects, making it useful for applications in photonics, microfluidics and biotec

Scientists at the Rogers Research Group at the University of Illinois at Urbana-Camp working on low cost soft lithographic approaches to fabricating 3D nanostructures in scalable to large areas. By adjusting the polarization and coherence of the light sour engineering specific geometries into the masks, they were able to demonstrate a wid capabilities for 3D patterning.

In a recent paper, titled "Fabricating three dimensional nanostructures using two pho single exposure step" Professor Rogers and his group, together with Gary Wiederrec National Laboratory presents a parallel, large area route to 3D nanostructures by two in thick transparent photopolymers.

Seokwoo Jeon, first author of the paper, explains the novelty of their findings to Nano approach enables 2-photon lithography to be performed in a completely parallel fash sharp contrast to conventional 2-photon methods that involve the serial scanning of a beam to 'write' 3D structures. The parallel operation of our method increases fabricat scalability to areas, by many orders of magnitude."

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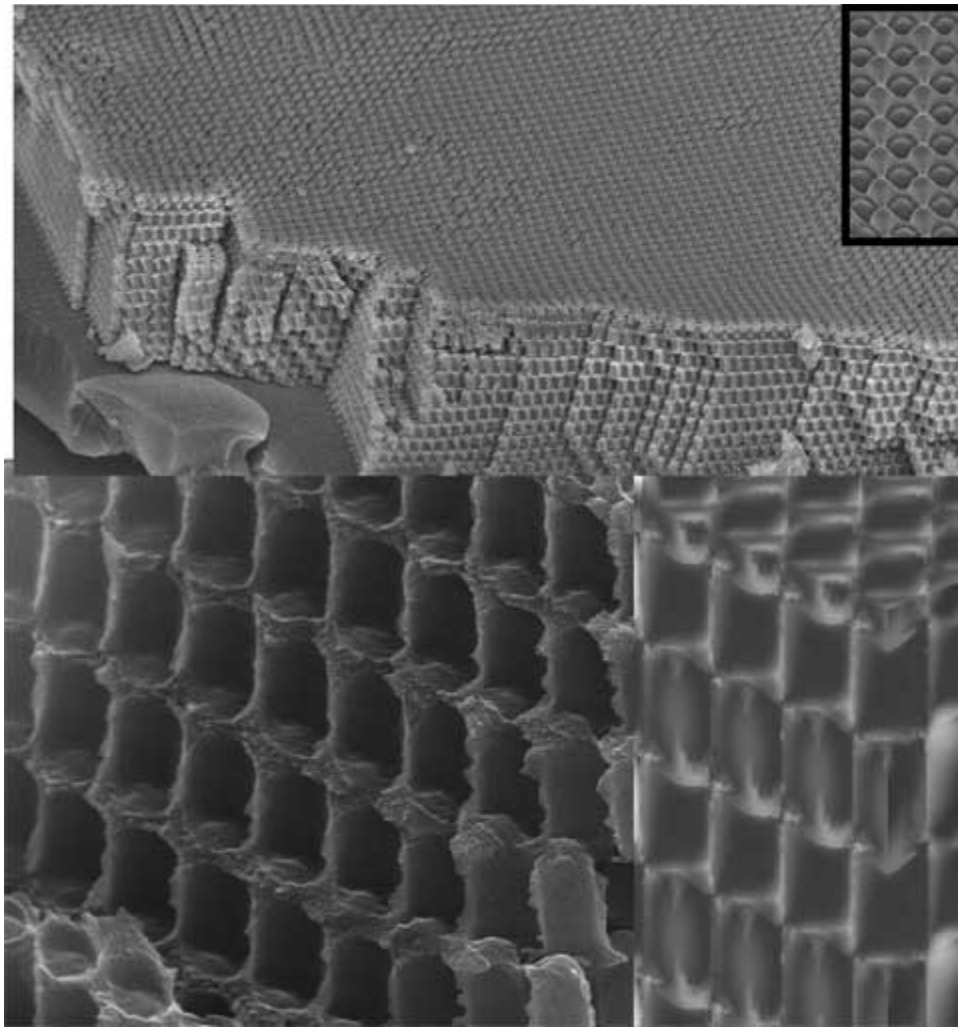

SEM images and modeling of 3D structures made through a two photon process wi area angled view and top view (inset) and (b) cross sectional view (left) and moc appropriately defined cutoff filter, close to the experimental condition, is chosen for Seokwoo Jeon, University of Illinois at Urbana-Campaign)

The problem with the use of such light sources in conventional methods (i.e. interfere that any combination of multiple beams of light from these pulsed lasers requires ext alignment and control to ensure spatial and temporal overlap of the pulses (which ha and temporal durations).

"In our approach" says Jeon, "we expose the 2-photon sensitive photopolymer direct surface of conformable masks that generates a 3D distribution of intensity. Separate beams and pulse overlaps is not required. In this way, we bypass the difficulties assc photon lithography in the conventional manner."

"However, even though we build 3D structures in parallel fashion, the required peak very high" says Jeon.

To make 3D structures in large area with higher speed, the design of more sensitive photopolymer is a key challenge to be overcome. Higher sensitivity would also allow pulse, so that the depth of 3D structures can be increased in proportion to that.

"The modeling is doable and we have the capabilities, but it is not trivial" says Jeon.

modeling of the optics to determine, for a given mask, the distribution of intensity nea
therefore, the geometry of the 3D structures that we can produce. We are currently w
powerful modeling tool that would allow us to solve the inverse problem, i.e. to deter
generate a phase mask to produce a desired 3D structure. With this type of tool we w
fully exploit the power of this patterning approach."

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