laser spot, and the information from scans of the sample is later converted to a two-dimensional image. One problem inherent in large-NA systems is a reduction in the depth of focus, causing a deterioration of image quality in the out-of-focus region. The synthetic-aperture focusing technique (SAFT), which employs a point detector such as a needle hydrophone, was developed to reduce this phenomenon. In the February 15 issue of *Optics Letters* (p. 474), M.L. Li of Texas A&M University and co-researchers have introduced a virtual detector for PAM that allows the SAFT to be applied to the large-NA transducer without losing depth of focus and eliminates the need for the point detector.

In this system, the focal point of the transducer is considered to be a virtual point detector. Li and colleagues said, "Photoacoustic (PA) waves that are generated within a certain solid angle are assumed to be detected by the virtual detector." Linear scanning of both the laser and the transducer creates a superposition of the PA waves produced by the biological tissue. This superposition, coupled with a coherence factor, facilitates synthetic-aperture focusing and is the basis for improved lateral resolution and signal-to-noise ratio.

The researchers offered a brief description of the PAM system, but focused largely on advances made using the new virtual point detector. First, a proof-of-principle study of a 6-µm carbon fiber immersed in 1% Intralipid solution was performed. In this study, "depth-independent lateral resolution of the carbon fiber" was achieved, "without affecting the axial resolution." Second, *in vivo* experiments were carried out on the scalps of rats. According to the researchers, the technique provides a much clearer vascular distribution that is attributed to improved lateral resolution and signal-to-noise ratio.

KEVIN P. HERLIHY

3D Nanostructures in Hydrogen Silsesquioxane Achieved by Proton Beam Writing

The most commonly used technique for three-dimensional (3D) nanolithography is e-beam writing. Therefore, different resists have been developed to define high-resolution features. Among them is $(HSiO_{3/2})_8$, a hydrogen silsesquioxane (HSQ) from Dow Corning. In HSQ, resolution below 20 nm has been reported and single lines down to 7 nm wide have been observed. Recently, it has been shown that HSQ can also be used as an extreme ultraviolet (EUV) resist using 13.4-nm wavelength, and 26-nm wide lines have been demonstrated. In the March 8 issue of *Nano Letters* (DOI: 10.1021/nl052478c; p. 579), J.A. van Kan, A.A. Bettiol, and F. Watt from the Centre for Ion Beam Applications at the National University of Singapore have presented their results on high-energy proton-beam writing (p-beam writing) in HSQ resist at the 20-nm level.

Their method employs a focused megaelectronvolt proton beam scanned in a predetermined pattern over a suitable resist that is subsequently chemically developed. The researchers said that in both electron-beam (e-beam) and p-beam writing, the energy loss of the primary beam is dominated by energy transfer to substrate electrons. Nevertheless, unlike the high-energy secondary electrons generated during e-beam writing, secondary electrons induced by the primary proton beam have low energy, typically less than 100 eV. Hence, the secondary electrons have a limited range, resulting in minimal proximity effects, thus enabling the fabrication of high-density 3D micro- and nanostructures with well-defined vertical, smooth side walls.

In this study, layers of HSQ deposited by spin-coating on silicon wafers were evaluated. They were pre-baked for 120 s at 150°C before p-beam exposure. After exposure, they were developed in a tetramethylammonium hydroxide (TMAH) solution. Squares of 5 µm × 5 µm were written with a focused 2-MeV p-beam, and the

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dose was varied in the 10–250 nC/mm^2 range. A contrast of 3.2 was found, similar to the values that have been reported for e-beam writing in HSQ. In subsequent experiments, the researchers have written parallel lines and gratings. They showed that by exposing an 850-nm-thick HSQ layer with a sufficiently high dose, the structures down to the 20-nm level remained standing without the use of supercritical drying, a process necessary for the successful development of e-beam–written structures. The researchers concluded that the performance of p-beam writing is dependent on how well the megaelectronvolt protons can be focused. The focused p-beam spot was measured to be 100 nm in diameter. The researchers said that the 20-nm linewidth was consistent with a process in which the dose at the peak of the beam was just enough to process the resist. Since p-beam technology is still in its infancy, the researchers foresee that its performance could be improved, and thus it is a promising new direct-write lithographic technique with great potential for 3D high-spatial-density nanofabrication.

ROSALÍA SERNA

Erratum

The schematic illustration of the basic self-assembly process featured on the cover and on p. 700 of the October 2005 issue of *MRS Bulletin* was reproduced with permission from the Web site of the FQRNT Centre for Self-Assembled Chemical Structures in Quebec, Canada.

Selective Recognition of Bacterial Membranes Achieved by Zinc(II) Coordination Complexes

The immune system and candidates for antimicrobial drug candidates need to have the ability to selectively recognize bacterial versus mammalian cell membranes *in vitro*. This recognition is usually mediated by components that are present on the surface of the cell. In an advance article of *Chemical Communications* (on-line publication, February 16; DOI: 10.1039/b517519d), B.D. Smith from the University of Notre Dame, W.M. Leevy from Notre Dame and Philip Morris, and their coworkers have reported selective recognition of bacterial membranes (*E. coli*, *P. aeruginosa*, and *S. aureus*) by fluorescently labeled bis[zinc(II)-DPA] coordination complexes. The fluorescent zinc-containing compounds were added to human saliva, which was chosen as a medium because it is well known to contain many types of bacteria as well as at least three types of mammalian cells. The researchers found that the bacteria were clearly stained by the zinc fluorescent probe in preference to the human cells. Another attribute of this staining procedure is that the compounds associate with the membrane surfaces and do not penetrate into the interior of bilayers, distinguishing between membranes on the basis of anionic surface charge on the bacterial membrane surface. This designer compound provides a platform that can be modified and expanded to numerous reporter constructs and antibiotic agents, the researchers said.

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