A new way to build nanostructures

A Massachusetts Institute of Technology, Cambridge, team is producing more complicated nanostructures using a blend of current “top-down” and “bottom-up” approaches. The method is a hybrid in which the self-assembled array is produced directly on a substrate material, performing the function of a mask for the lithography process. The individual nanoparticles that assemble on the surface each serve as tiny lenses, focusing the beam into an intensity pattern determined by their arrangement on the surface. The method, the authors say in their paper, “can be implemented as a novel technique to fabricate complex 3-D nanostructures in all fields of nanoscale research.”

Depending on the shapes and arrangements of the tiny glass beads used for the self-assembly part of the process, it is possible to create a variety of structures, “from holes to higher-density posts, rings, flowery structures, all using the exact same system,” says one researcher. “It’s a very simple way to make 3-D nanostructures, and probably the cheapest way right now. You can use it for many things.” www.mit.edu.

Coating gives nanowires increased efficiency and sensitivity

By applying a coating to individual silicon nanowires, researchers at Harvard University, Cambridge, Mass., and University of California, Berkeley, significantly improved the material’s efficiency and sensitivity. Due to a large surface-to-volume ratio, nanowires typically suffer from a high surface recombination rate, meaning that photogenerated charges recombine rather than being collected at the terminals, shortening carrier life and efficiency. By comparison, single nanowires coated with an amorphous silicon layer have significantly lower surface recombination.

The coating was created by accident. During preparation of a batch of single-crystal silicon nanowires, small gold particles used to grow the nanowires became depleted. As a result, the amorphous silicon coating was simply deposited onto the individual wires. Scanning photocurrent studies of the batch indicated almost a 100-fold reduction in surface recombination. Overall, the coated wires boast a 90-fold increase in photosensitivity compared with uncoated ones. www.harvard.edu; www.berkeley.edu.

New laser technology could kill viruses and improve DVDs

A team at the University of California, Riverside Bourns College of Engineering made a discovery in semiconductor nanowire laser technology that could potentially do everything from killing viruses to increasing storage capacity of DVDs. Ultraviolet semiconductor diode lasers are widely used in data processing, information storage, and biology, but applications are limited by size, cost, and power. The current generation of ultraviolet lasers is based on gallium nitride, but researchers made a breakthrough in zinc-oxide nanowire waveguide lasers, which can offer smaller sizes, lower costs, higher powers, and shorter wavelengths.

Until now, zinc-oxide nanowires could not be used in real-world light emission applications because of the lack of p-type material needed by all semiconductors. The problem was solved by doping the zinc-oxide nanowires with antimony to create the p-type material. The p-type zinc-oxide nanowires were connected with n-type zinc-oxide material to form a p-n junction diode. Powered by a battery, highly directional laser light emits only from the ends of the nanowires. www.engr.ucr.edu.