newsbreaks

Porous silicon microcavities have subnanometer linewidths

Resonant microcavities can be made of porous silicon (*P*Si), a material that has the advantage of an index of refraction that can be varied by changing the porosity. Researchers at the University of New South Wales (Sydney, Australia) are now fabricating high-quality *P*Si microcavities that have resonances with subnanometer linewidths. The structures are prepared by low-temperature (–22.5°C) anodic oxidation of highly doped *p*-type Si. The constant-current densities required to create the high (82.5%) and low (33%)-porosity layers in a cavity with a resonance at 900 nm are 10 and 86 mA/cm^2 respectively.

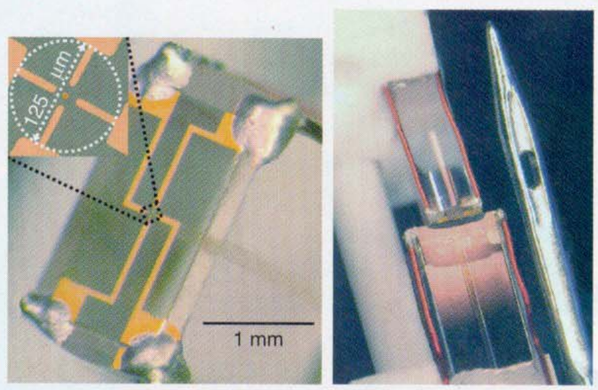
The result is a microcavity with a virtually 100% reflectance over a 720- to 1100-nm wavelength band, with a reflectance dip to 40% at 914 nm; the dip has a bandwidth of 0.63 nm. Photoluminescence measurements of the weakly photoluminescent material reveal a resonant peak at 911 nm with a 0.79-nm width, with no other peaks. Theory predicts a 0.1-nm (reflectivity) resonance linewidth; the 0.63-nm measurement shows the role of optical losses in the device (in this instance, the effects of optical absorption and a large collection angle predominate). *Contact Peter Reece at* pjr@phys.unsw.edu.au.

Thulium-doped fiber laser emits 4.1-kW-peak-power pulses at near 2 µm

A group at the University of Manchester (Manchester, England) has developed a thulium (Tm)-doped silica fiber laser that emits 150-ns pulses of 4.1-kW peak power at 1945.7 nm with a 0.1-nm bandwidth-it is claimed by the researchers to be the first high-peak-power operation of a Tm-fiber laser. The fiber has a Tm concentration of 1.1 wt.%, a numerical aperture of 0.24, and a core diameter of 17 µm, allowing it to support several modes at the lasing wavelength. The pump source is a Nd:YAG laser operating at 1.319 µm and is focused into the end of the fiber with an infrared microscope objective. Mirrors with 99% and 80% reflectivity placed in collimated light from the ends of the fiber served as cavity mirrors.

An acousto-optic modulator operated at rates to 30 kHz provided *Q*-switching of the fiber laser. Thulium-doped fiber lasers of 2.9, 2.5, 1.8, and 1-m length had average output powers of 120, 105, 90, and 60 mW, respectively. The beam-quality factor M^2 was found to be 1.5. Several orders of stimulated Brillouin scattering separated by 0.15 nm each were observed at high peak powers and repetition rates. *Contact Terry King at* terry.king@man.ac.uk.

In-fiber liquid-crystal modulator switches at microsecond speeds



A nematic liquid-crystal (NLC) optical modulator that fits between two single-mode fibers has been fabricated by researchers at Lucent Technologies' Bell Labs (Murray Hill, NJ), the University of Minnesota (Minneapolis, MN), and Brookhaven National Laboratory (Upton, NY). The NLC cell is bounded by the tips of the fibers themselves, in between which are mounted microfabricated electrodes. Filled with the proper NLC material, the modulator operates at polarization-rotating speeds of 1°/µs over an angular range of 1° to 60°.

Gold electrodes (left; complete device shown at right with sewing needle for size comparison) are patterned onto two thin glass substrates and a polyimide spin cast onto the substrates to keep the NLC aligned perpendicular to the substrate surfaces. Glass spacer rods 5.5-µm thick create a small gap between the substrates, which is filled at 70°C with a NLC in isotropic phase, then cooled to room temperature. An electric field between the electrodes temporarily reorients the NLC parallel to the substrates for modulation. A pulsed driving scheme decreases the switching time by a factor of 50 over other methods. The device could find use in polarization analysis and control systems. *Contact John Rogers at* jarogers@lucent.com