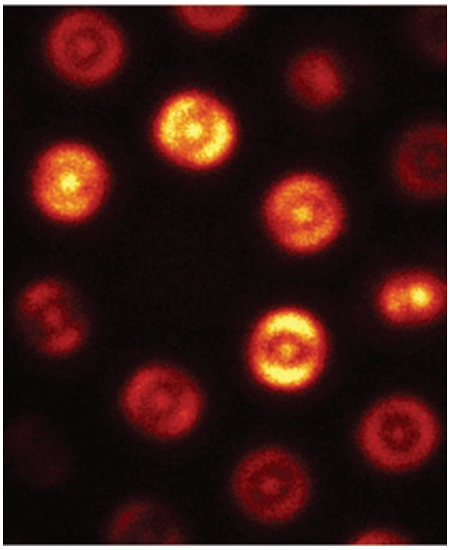
Under pressure

Opt. Lett. **36,** 2432–2434 (2011)



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Photonic crystal fibres, which guide light by exploiting photonic bandgaps, are traditionally fabricated using the fibre-drawing technique. Nicolai Granzow and colleagues in Germany and Russia have now produced 1.45-μm-diameter waveguides from a silica fibre containing strands of chalcogenide glass. The sulphur-based chalcogenide glass ($Ga_4Ge_{21}Sb_{10}S_{65}$) is unsuitable for conventional fibre drawing and has a refractive index of 2.27, which results in a large step change in refractive index at the interface between air and the fibre. The researchers fabricated a 10-cm-long silica fibre from a solid glass core surrounded by six air channels measuring 1.45 μm in diameter. They fused the hollow channels shut and placed the open end of the fibre in a crucible containing only 0.02 g of chalcogenide glass. They then placed the crucible into a furnace at 665 °C, which allowed the chalcogenide melt to fill the fibre holes. When analysing the fibres with white light from a supercontinuum source, the researchers identified seven low-loss transmission windows along the strands and an optimal transmission wavelength of 750 nm. The structures are hoped to be useful for infrared supercontinuum sources and integrated optical isolators using magneto-optic glasses. *DP*

Beyond 2 μm

Photon. Technol. Lett. **23,** 682–684 (2011)

High-energy and high-peak-power pulsed lasers are desirable for a myriad of applications in the mid-infrared region, including optical parametric oscillation and supercontinuum generation. Now, using a 1.4-m-long thulium-holmium-co-doped silicate fibre, Qing Wang and co-workers from AdValue Photonics in Arizona, USA, have built a passively mode-locked fibre laser that may suit such applications. The fibre was fabricated in-house using a 'rod-in-tube' technique. The doped core has a diameter of 10.5 μm, whereas the undoped inner and outer claddings are 125 μm and 150 μm, respectively. The researchers inserted a solid rod into the inner cladding to enhance cladding-pump absorption. The laser itself is composed of an antimony-based semiconductor saturable absorber mirror, a pump combiner and a fibre loop mirror. When the cladding was pumped with 0.8 μm light at around 4 W, the researchers observed the generation of mode-locked solitons with a wavelength of 2.06 μm, a pulse energy of 0.41 nJ and a pulse duration of 1.1 ps. They say that this device can be used to obtain femtosecond mode-locked pulses through appropriate dispersion compensation. *RW*

Single-crystal fibre boost

Opt. Express **19,** 11667–11679 (2011)

Passively *Q*-switched Nd:YAG lasers are compact and convenient sources of subnanosecond pulses, but emit pulses with relatively low energy. Fibre amplifiers can be used to boost the output energy of such devices to around 8.4 mJ at repetition rates of 25 Hz, but this is too slow for applications in materials processing or high-precision ranging and imaging, which often require repetition rates of 1–100 kHz. Igor Martial and co-workers in France have now demonstrated that Nd:YAG single-crystal fibres can be used to amplify pulses from a *Q*-switched microlaser to average powers of up to 20 W at repetition rates of over 40 kHz for a pulse duration of 1 ns. They show that suitable Nd:YAG crystal geometries can provide equal or even greater performance than traditional fibre amplifiers for subnanosecond pulses. *JB*

Going for green

Opt. Lett. **36,** 1836–1838 (2011)

Visible-wavelength lasers have applications in medicine, laser processing, biology, metrology, optical storage and laser displays, among others. Significant research has been made into the development of visible-wavelength semiconductor lasers for projector devices, and although such devices are very simple to use, their maximum output power in the range of 500–600 nm is limited to around 50 mW. Jun Nakanishi and co-workers in Japan have now developed a praseodymium-doped waterproof fluoride glass fibre laser that can achieve powers of around 598 mW at a wavelength of 522.2 nm.

The researchers first combined the beams from two GaN lasers diodes — one of which was p-polarized, the other s-polarized — at a beamsplitter. They then focused the combined beam onto a praseodymium-doped waterproof fluoroaluminate glass fibre input surface and used a prism to remove any residual excitation. Both laser diodes operated at their maximum operating current of 1,200 mA, achieving powers of 971 mW for the p-polarization and 1,364 mW for the s-polarization. The researchers say that their device could be a promising alternative to frequency-doubling for generating visible light. *JB*

Stronger nanofibres

J. Lightwave Technol. **29,** 1018–1025 (2011)

Nanostructured optical fibres offer custom-designed dispersion, high strength and high fabrication efficiency — properties that make them attractive for use in a wide range of miniature high-performance photonic devices. Although a nanostructured fibre can be fabricated in the same way as a microstructured fibre — by drawing a structural preform at the glass-softening temperature — slight non-uniformities in the preform can cause the fibre to deform or even collapse. Meisong Liao and co-workers in Japan have now circumvented some of the difficulties associated with nanostructured fibre fabrication by analysing the non-uniformity of hole evolution during the fibre-drawing process. The researchers found that hole size is a key factor in the stability of the fibre, and that small holes increase the likelihood of fibre collapse. The researchers claim to have fabricated a fibre with the smallest ever fibre core by using an inflation method to increase the hole size. For a 120-nm-long nanostructured fibre, they achieved a glass bridge thickness of only a few tens of nanometres. They also showed that high drawing temperatures cause an increase in surface tension but a significant decrease in viscosity, which leads to severe fibre distortion. *JB*

Written by James Baxter, David Pile and Rachel Won.