When a voltage is applied between the steel wire cathode and the CNT sheet anode, the wire starts to generate light and after a turn-on time of several minutes a luminance of 125 cd m^{-2} is achieved. Although the luminance is almost independent of the viewing angle, its intensity level slowly decreases after reaching the maximum, which highlights the limited stability of the light-emitting fibre. Blue and yellow emitting fibres were prepared using the approach described above (Fig. 2). The light-emitting fibres are quite flexible and can be bent repeatedly without any significant loss in performance, allowing them to be woven into fabrics. The authors demonstrated this by preparing single- and dual-colour light-emitting fabrics.

The major remaining challenge for the widespread use of these light-emitting fibres is to increase their operational stability. Currently, the luminance of the fibres decreases by a factor of two from 130 to 65 cd m^{-2} in only four hours when driven at a constant current density of 30 mA cm^{-2}. However, several recent publications report LECs with stabilities in excess of several thousand hours[7,8]. The approaches used in these reports seem to be compatible with the fibre production and therefore hold promise for future improvements.

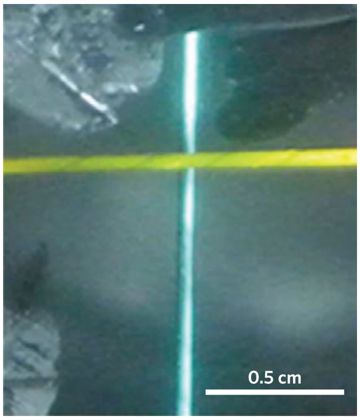

Figure 2 | Prototype of the light-emitting fibre. Image courtesy of Huisheng Peng.

In summary, the method developed by Zhang *et al.*[1] is a major step forward in the preparation of light-emitting fibres that suit integration with woven fabrics. Future improvements, such as the scaling up of the CNT wrapping process for applying the transparent outer electrode to the light-emitting-layer coated wire and the implementation of suitable encapsulation for protecting the fibres will be required before they are ready for practical applications. ❐

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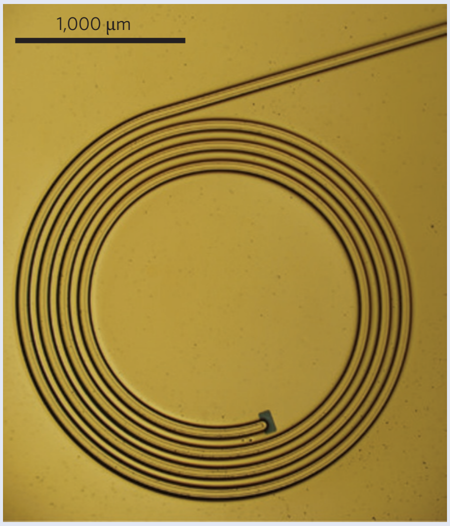
MID-INFRARED PHOTONICS

Spiral superluminescent emitter

Superluminescent (SL) light sources, which offer the beneficial combination of a broad emission bandwidth with low temporal and high spatial coherence, have many potential industrial and medical applications. In particular, mid-infrared (MIR) SL light sources that are suitable for use in an optical coherence tomography system would be attractive for the biomedical imaging of cancerous tissues and collagen, for example. However, an appropriate MIR SL light source that offers the milliwatt power level needed for such applications has so far been lacking.

Mei C. Zheng and co-workers at Princeton University and AdTech Optics Inc. in the USA have now developed such a light source based on a quantum cascade (QC) device implemented in a spiral-shaped cavity. The 12-mm-long device emits an output power of 57 mW at a temperature of 250 K (*Opt. Express* **23,** 2713–2719; 2015).

The QC active core was based on InGaAs/AlInAs multi-quantum wells and was designed to have an emission wavelength around 5 μm at 80 K. The team adopted a spiral waveguide design to achieve a long waveguide and thus a higher SL power while still retaining a compact footprint.



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The device was composed of a waveguide (25 μm wide and 6 μm deep) arranged in a spiral shape (with a minimum spiral radius of 380 μm), which, after several turns, transitions to a straight waveguide that is 1,325 μm long. The straight waveguide was tilted from the cleavage plane by 17° to suppress the residual reflection from the front facets. The spiral design allowed a total waveguide length of 12 mm, with a footprint of 3 × 3 mm^2.

Light, current, and voltage characterization of the device was performed in pulsed mode with a current pulse width of 100 ns and a repetition rate of 5 kHz. Optical emission from the device was collimated and focused onto a room temperature HgCdTe detector by a pair of ZnSe lenses. An SL power of 57 mW was obtained just below the lasing threshold of 2.5 kA cm^{-2}. The emission spectra showed a broad Gaussian shape with a full width at half maximum of 56 cm^{-1} wavenumbers. A coherence length of 107 μm was determined from the interferograms.

"The next challenge of this work is to increase the SL power even more by further suppressing the lasing threshold in addition to reducing the input power required so that this device can be more efficient," Zheng told *Nature Photonics*.

NORIAKI HORIUCHI