Discovery cuts cost of next generation optical fibers

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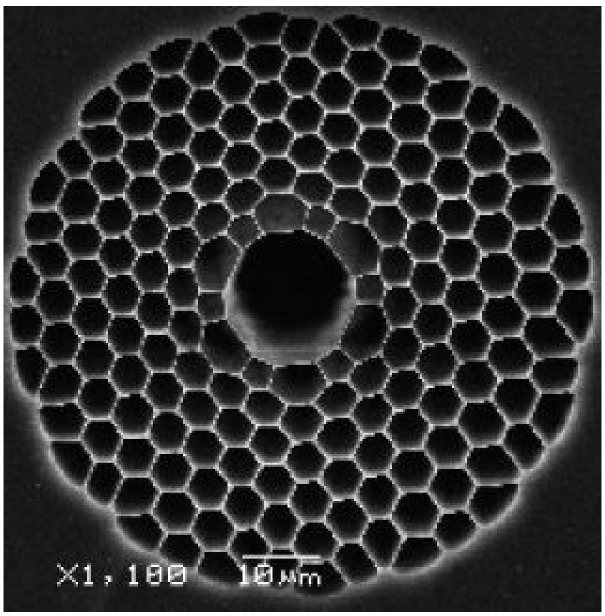

Electron microscope image of the hollow-core fiber. Credit: University of Bath

Scientists have discovered a way of speeding up the production of hollow-core optical fibres - a new generation of optical fibres that could lead to faster and more powerful computing and telecommunications technologies.

The procedure, described today in the journal *Optics Express*, cuts the production time of hollow-core optical fibres from around a week to a single day, reducing the overall cost of fabrication.

Initial tests show that the fibre is also superior in virtually every respect to previous versions of the technology, making it an important step in the development of new technologies that use light instead of electrical circuits to carry information.

These technologies include faster optical telecommunications, more powerful and accurate laser machining, and the cheaper generation of x-ray or ultra-violet light for use in biomedical and surgical optics.

“This is a major improvement in the development of hollow-core fibre technology,” said Professor Jonathan Knight from the Centre for Photonics & Photonic Materials in the Department of Physics at the University of Bath.

“In standard optical fibres, light travels in a small cylindrical core of glass running down the fibre length.

“The fact that light has to travel through glass limits them in many ways. For example, the glass can be damaged if there is too much light.

“Also, the glass causes short pulses of light to spread out in a blurring effect that makes them less well defined. This limits its usefulness in telecommunications and other applications.

“Hence, fibres in which light travels in air down a hollow core hold great promise for a next generation of optical fibres with performance enhanced in many ways.”

The problem in developing hollow-core fibres is that only a special sort of optical fibre can guide light down an air hole. They use a two-dimensional pattern of tiny holes in the glass around the core to trap the light within the core itself.

The highly detailed nature of these fibres means that they have been difficult to fabricate and they can only work for a limited range of wavelengths.

However, the new procedure developed by the Bath photonics group shows how a tiny change to these fibres – narrowing the wall of glass around the large central hole by just a hundred nanometres (a 10 millionth of a metre) – broadens the range of wavelengths which can be transmitted.

They achieved this by omitting some of the most difficult steps in the fabrication procedure, reducing the time required to make the fibres from around a week to a single day.

The improved fibre was developed as part of a European Commission-funded Framework 6 project 'NextGenPCF' for applications in gas sensing.

However, the superior performance of the fibre means that it could have a significant impact in a range of fields such as laser design and pulsed beam delivery, spectroscopy, biomedical and surgical optics, laser machining, the automotive industry and space science.

"The consequences of being able to use light rather than electrical circuits to carry information will be fundamental," said Professor Knight.

"It will make optical fibres many times more powerful and brings the day when information technology will consist of optical devices rather than less efficient electronic circuits much closer. For biomedical research, we can use these fibres to deliver light for diagnosis or surgery anywhere – even deep inside the body. Almost any device where light is important or can be used, photonic crystal fibres can make more efficient, sensitive and powerful.”

Citation: ‘Control of surface modes in low loss hollow-core photonic bandgap fibers’, *Optics Express*, Vol. 16, Issue 2, pp. 1142-1149.

Source: University of Bath