Research Infrastructure

Canada Research Chair in Photonic Crystals

The infinite potential of microstructured fibres

Optical fibres can serve as a vehicle for much more than light waves, as the work of Maksim Skorobogatiy and his team at the Canada Research Chair in Photonic Crystals has shown.

"Microstructured fibres are a very versatile technology," Professor Skorobogatiy says. "They can be used to circulate other substances besides energy."

The Skorobogatiy team's ongoing exploration of the properties of microstructured optical fibres has just made significant progress, thanks to the Chair's acquisition of an optical fibre draw tower. The equipment, which represents a $300,000 investment, allows complex-structure fibres to be produced on an industrial scale.

"The fabrication principle is relatively simple," says Professor Skorobogatiy. "Capillary tubes are placed in a polymer casing to make a preform, which is then affixed to the top of the draw tower in a 'clean room.' The fibres are then subjected to continuous heat and tension and pulled out of the preform. They can attain a length of several hundred metres."

This makes it possible to create fibres with highly varied guidance properties, based on the number of capillaries inserted into the original casing, the casing's thickness, and the tension to which the preform is subjected. In addition, many different functionalities can be introduced into the same fibre—optics, microfluids, mechanical activation, and so on, depending on the materials and structure selected for the fibre.

"École Polytechnique has acquired an exceptional piece of equipment," Professor Skorobogatiy notes. "We have also developed a special machine for sectioning the fibre without destroying its structure, which means we can now produce specific fibres for extremely precise applications."

The Chair has made its most promising advance in the biomedical field. In developing a biodegradable, biocompatible optical fibre capable of transmitting laser light and carrying medicinal substances into an organism, the team has created a type of "super-syringe." The device consists of porous polymer tubing just a few hundred microns in diameter into which another tube is inserted. The central tube conducts the laser beam to its target, while the outer tube enables reflected light to be collected through the walls of the central tube for analysis.

Maksim Skorobogatiy

"In the fibre preform, medication particles can be inserted between two tubes with porous walls," Professor Skorobogatiy says. "Once pulled, this structure retains the properties of the medication, which is transmitted along the fibres at the same time as the laser beam. It's a very advantageous development for medical laser treatments: for instance, the medical substance can be used to relieve pain or sterilize the treated areas."