International tech mash-up for laser beam transmitting glass fibres

The precision delivery of carbon dioxide lasers used in medical procedures and advanced manufacturing may soon be boosted thanks to a new type of flexible hollow-core glass fibre developed through a collaboration between the University of Adelaide and USA company IRflex Corporation.

Supported by a grant from the Global Connections Fund (GCF), the project aimed to develop the next-gen glass fibre to improve the efficiency of delivering a carbon dioxide laser beam across a wide range of applications, from skin resurfacing to 3D printing.

“This funding allowed us to collaborate and exchange highly specialised expertise with IRflex towards the development of this novel kind of glass optical fibre,” explained Professor Heike Ebendorff-Heidepriem, who is the Deputy Director at the Institute for Photonics and Advanced Sensing (IPAS) at the University of Adelaide.

“The approaches we have developed through this collaboration have helped us advance our glass fabrication techniques, which has already been invaluable for countless other projects – demonstrating the breadth of impact achieved through this grant.”

IPAS is a research institute specialising in photonics, the science of light, and renowned worldwide for its specialty optical glass and microstructured optical fibres. Each fibre is just the thickness of a human hair, and contains multiple narrow air channels. The special fibres made within the collaboration transmit the light through the air, allowing for much more to be passed through than would be possible with a conventional solid glass fibre.

Through access to the IPAS-embedded Optofab node of the Australian National Fabrication Facility, which includes 3D metal printing capabilities, Professor Ebendorff-Heidepriem’s team designs and fabricates the high quality titanium dies which are used to create large-scale versions of glass fibres, known as preforms.

These are about one centimetre in diameter, and have internal holes running through their length. They are then stretched using a fibre draw tower, creating long lengths of optical fibres with even narrower air channels.

IRflex was chosen as the ideal industry partner for this project because of its expertise and specialised equipment for making the glass that is ideal for transmitting carbon dioxide laser beams, known as chalcogenide glass.

“Getting the structure of the titanium die right is vital to produce the fibre with the required properties, and a suitable type of glass is vital to make sure you can transmit the energy,” explained Professor Ebendorff-Heidepriem.

With promising early steps, she has now applied for an Australian Research Council Linkage Grant to move the collaborative project forward, for laser beam transmission and sensing.

In particular, she’d like to reduce the costs of working with the chalcogenide glass by using computer modelling to conduct the preform fabrication step on a virtual level, to better understand the complex flow of glass through dies. Currently there are no commercial fibre solutions available on the market for high-precision transmission of high-power laser beams in the mid-infrared range, a crucial requirement for application of mid-infrared lasers such as carbon dioxide lasers.

Professor Heike Ebendorff-Heidepriem

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Hollow-core glass fibres developed by @UniofAdelaide’s Heike Ebendorff-Heidepriem and US company IRflex Corp at @ANFFHQ, thanks to the @IndustryGovAu Global Connections Fund.
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