FLAT-OPTICAL FIBRE FOR A FASTER FUTURE

S. Ambran[1], C. Holmes[1], J. C. Gates[1], A. S. Webb[1], M. F. R. Adikan[2], P. G. R. Smith[1], J. K. Sahu[1]
1. Optoelectronics Research Centre, University of Southampton, UK, SO17 1BJ
2. Photonics Research Centre, University of Malaya, Malaysia

High-speed optical telecommunication has revolutionised the modern age, severing as a high-tech backbone for businesses and individuals. Through rethinking the design of optical fibres, this work aims to address global demand for a faster telecommunication infrastructure.

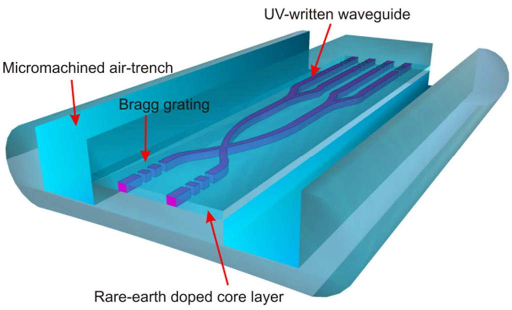
The UK Government's National Infrastructure Plan 2011 included a budget allocation of £100 million for superfast broadband (up to 100 Mbps) in ten "super-connected cities" across the country [1]. To make this possible requires the development of enhanced optical devices to support the higher broadband capacity at lower costs. As a platform silica glass based fibres are clearly recognised as the material of choice for communications offering low cost, long device lifetimes, as well as environmental stability. However, fibres, while ideal for point-to-point communications are not suitable for the branching and splitting of light signals. Here, we use a silica glass based flat-fibre technology as a platform to develop an integrated planar optical device. The benefits offered by flat-fibre compared to standard optical fibres (and conventional planar waveguides) are presented in Figure 1(a).

This work reports the development of the flat-fibre technology which has been patented by University of Southampton [2]. The flat-fibre fabrication uses existing commercial silica fibre technology. This leads to the low-cost fabrication compared to other planar material platforms. In conjunction with an Ultra-Violet (UV) writing technique, optical circuitry can be designed in the flat-fibre, presenting more compact passive devices for the manipulation of light signals.

Properties Comparison

	Optical fibre	Planar waveguide	Flat-fibre
Low Loss	Yes	No	Yes
Loss Cost	Yes	No	Yes
Multi-function	No	Yes	Yes
Long Length	Yes	No	Yes
Mechanically Flexible	Yes	No	Yes
High Uniformity	Yes	No	Yes

(a)



(b)

Figure 1 (a) Properties comparison between optical fibre, planar waveguide and flat-fibre and (b) optical circuitry in a hybrid passive and active device in a single platform

Recently, we have fabricated a multimode interference (MMI) splitter device via ultra-micromachining technique [3]. Following this, we are presently developing an active integrated planar device by adding a rare-earth ion into the composition of the flat-fibre core layer. This leads to an opportunity for amplifying or lasing characteristics in the flexible-long-length flat-fibre device. This opens up potential for a hybrid device combining passive and active components in a single chip in order to yield a more compact and cost effective optical device as illustrated in Figure 1(b).

We anticipate that the technology presented here will have a major impact on the future of high speed optical networking up to 1Gbps per home for fibre to the home (FTTH) technology.

Acknowledgment: This work is sponsored by EPSRC, Ministry of Higher Education, Government of Malaysia and University Technology of Malaysia.

[1] The National Infrastructure Plan 2011, United Kingdom, http://www.hm-treasury.gov.uk/national_infrastructure_plan2011.htm
[2] F. R. M. Adikan, et al, "Method of fabricating a Planar Substrate having Optical Waveguides," Patent Application Publication, US 2010/0284660 A1, 2010
[3] S. Ambran, et al, "Fabrication of a Multimode Interference Device in a Low Loss Flat-fiber Platform using Physical Micromachining Technique," (submitted) in Journal of Lightwave Technology, 2011