# Direct Grating Writing: Single-step Bragg grating and waveguide fabrication for telecommunications and sensing applications

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## Abstract

Direct Grating Writing (DGW) has been developed over the past decade as a means of rapidly prototyping waveguides with integrated Bragg grating structures in silica-on-silicon substrates [1]. The technique allows complicated waveguide structures and Bragg grating arrays to be fabricated and characterised in house.

The key feature of the DGW system is the crossed-beam arrangement depicted in Fig. 1(b). A UV beam passes through an acousto-optic modulator (AOM) to a 50:50 beamsplitter. The two equal path-length arms of the interferometer are focussed to a crossing point, where an interference pattern containing ~10 fringes is present within the ~5 μm spot. The intersection angle of the beams determines the range of grating periods which can be defined using the system [2]. Translating the photosensitive sample within the focus of the crossed beams induces a positive refractive index change, creating a waveguiding region. Modulating the intensity of the interference pattern creates the periodic refractive index change forming a Bragg grating.

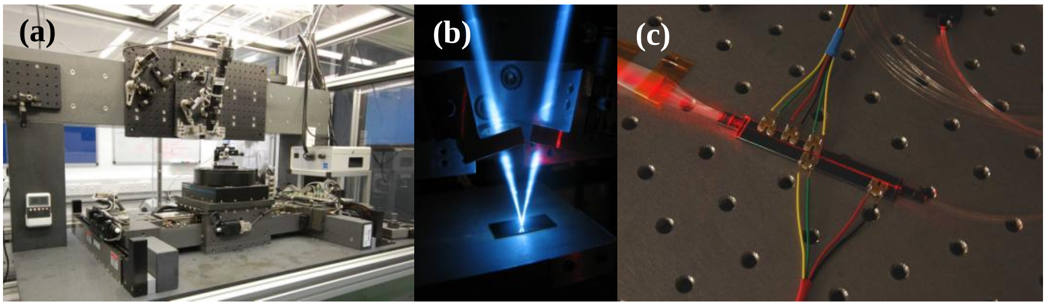


Fig. 1. (a)Picture of the UV writing system, (b) the focussed crossed beams in the process writing a planar waveguide and (c) an image of a fibre coupled planar lightwave circuit fabricated using the system.

The DGW system has been used to produce a number of devices for various applications. Recent work has developed techniques that apply integrated Bragg gratings to precisely characterise the loss and dispersion properties of the waveguides [3]. The structures also produce devices for environmental sensing, detecting strain, temperature and chemical changes on the sample surface [4]. Combining DGW with machining of the glass substrates has led to development of cantilever structures [5], which could be used for more advanced sensing applications. The system has also been used to inscribe gratings in novel substrates, such as the hybrid planar-fibre called 'flat fibre'.

We will present an overview of our recent DGW developments, highlighting new devices and alterations to the DGW system in order to further diversify the uses of the process.

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## References

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