3D Printed Mechanically Induced Long-Period Fiber Grating for Power Attenuation

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1. Introduction

A long-period fiber grating (LPFG) has a key ability of mode coupling from fundamental core mode to cladding modes. This can be beneficially used as a fiber optic filter. Mechanically induced LPFG has been developed in recent years for simpler technique comparing with other methods i.e. irradiation by CO_2 lasers [1], arc discharge [2], and etching discharge [3]. In addition, there are several types of mechanically induced LPFGs [4]. This paper presents the novel 3D printed mechanically induced LPFG, that is printed by a translucent and hard material called RGD720. This mechanically induced LPFG is directly pushed on to the fiber as perturbation point to attenuate the power.

2. Experimental setup

In this paper, the proposed mechanically induced LPFG is designed as a rectangular structure with 60° triangular shaped vortex to be a part of grating period with the help of SolidWorks software. The experimental setup illustrated in Fig. 1 (a) consists of a DFB laser emitting at 1550 nm as a light source, a pair of single-mode optical fiber patch cord with FC-connector as a medium, an LPFG as a source of perturbation, and an optical spectrum analyzer (OSA) at a receiving end to characterize the spectral output. The fiber optic patch cables are cleaved and spliced to a bare fiber used as the probe. Each splice yields 0.01 dB loss, thus, the total splice loss would be 0.02 dB. The perturbation is mechanically induced by pressing LPFG on the probe where a flat metal plate is located under the fiber to support the applied force.

3. Experimental results

The reference spectral output without perturbation is initially recorded by OSA as illustrated in Fig. 2. The maximum power read at -5.77 dBm at the wavelength of 1555.870 nm. When LPFG with 500 µm grating period and 35 mm length as shown in Fig.1 (b) is mechanically applied on to a bare fiber, the maximum power at the mentioned wavelength is attenuated to -9.63 dBm. Then, we tilted an LPFG 19.78° with respect to the fiber axis, the grating period, touching the probe, could be expanded to 531 µm and this results in the reduction of the maximum power to -12.22 dBm at the same wavelength. Both mechanical inductions on LPFG are carefully done with the same amount of force at 5.3 kg read by the force meter.

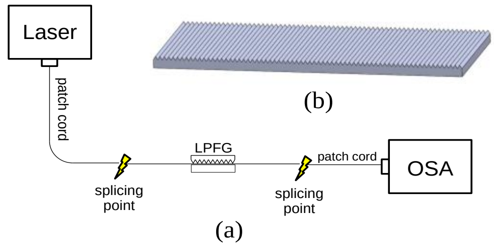

Fig. 1. (a) Experimental setup and (b) LPFG structure

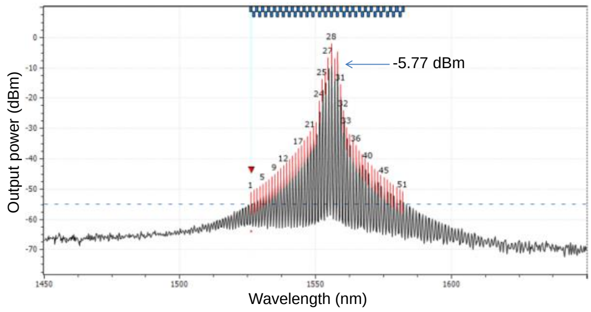

Fig. 2. A reference spectral output without perturbation by LPFG

4. Conclusion

Grating period plays a big role to the output power. This phenomenon can be applied to the weight sensor or other sensors based on the principle of the optical power attenuation due to the mode coupling from fundamental mode to cladding modes.

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Reference

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