THE NEW GAIN FLATTENING FILTERS USING PERIODIC TAPERED FIBER

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ABSTRACT

We propose the new gain-flattened filter utilizing tapered silica-based fiber for high capacity WDM optical communication systems. The gain excursion of Gain flattening filters is less than 0.5 dB over the 40 nm(1525 nm ~1565 nm).

1.Introduction

In recent years, the gain flattening filter of erbium-doped fiber amplifier (EDFA) has been a research issue for high capacity WDM optical communication system. When a system is only required one wavelength, the gain variation is not much of a concern. However, with 8, 16, 32 and more high-count wavelength channels, the transmission problem arise because a conventional silica-based EDFA has intrinsic gain of non-uniformity. Usually, the problem can be solved using an optical gain flattening filter (GFF). The effect of gain flattening filters is shown in Figure 1.

In this paper, we propose a new type gain flattened filter utilizing twist fused and elongated fiber with silica based fiber.

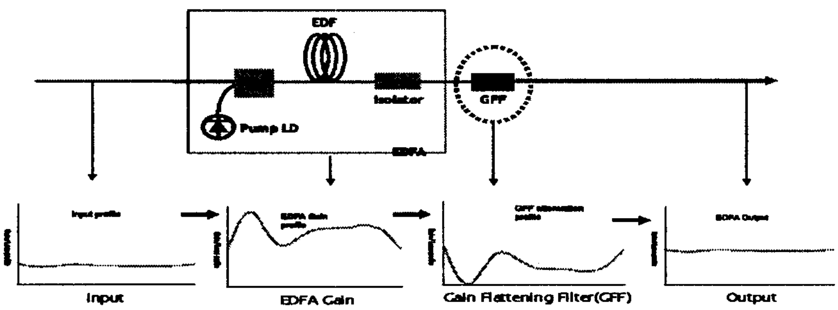

Figure 1. The effects of gain flattening filters

2. New type GFF Design and fabrication

The configuration of new GFF is shown in figure 2. The main region of tapered fiber plays the role as amplified spontaneous emission (ASE) rejection filter. The absorption property of tapered fiber compensates for the highest gain peak of EDFA in nearby 1530 nm wavelengths. The major absorption peak of tapered fiber almost coincides with the emission peak of EDFA.

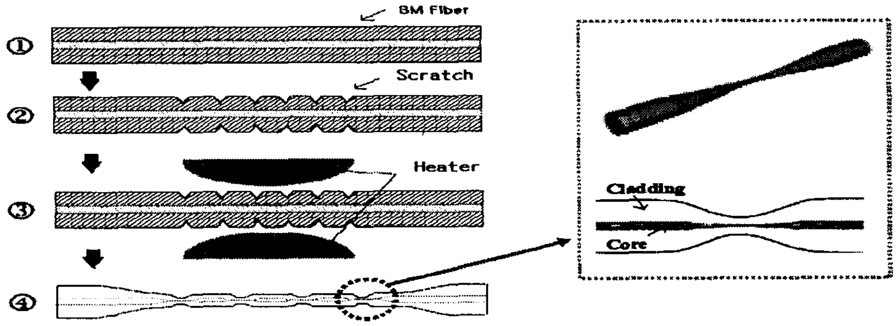

Figure 2. The scheme of the GFF

A tapered SM (single mode) fiber is obtained by local heating and stretching of fiber. Tapered sections are produced on a specially adapted fused fiber coupler jig. The tapered sections are pulled by locally heating a length of fiber using a micro torch with a flame size of approximately 900 microns and pulling the fiber apart using two high precision motors. The taper angle is small enough to ensure negligible loss of power and the fiber's transmission is not affected by the tapering process at 1530nm. In the central region of the structure, the waveguide is ensured by the fused cladding which plays the role of a core, air being as the cladding. This process is repeated sequentially until the desired filter profile is attained. But EDFA emission spectrum is not perfectly coincident with main region of tapered fiber absorption spectrum. And so, trimming process is needed.

3. Conclusion

Gain flattening filters have been produced using a tapered fiber technique enabling the assembly of low gain ripple EDFAs for WDM systems. The gain excursion is less than 0.5 dB over the 40 nm(1530 nm ~ 1560 nm) wavelength range. The gain flatness and the total bandwidth can be design further improved with a better fitting of the GFF.

[References]

[1] S. F. Su, R. Olshansky, D. A. Smith, and J. E. Baran, "Flattening of Erbium-doped fiber amplifier gain spectrum using an acousto-optic tunable filter," Electron. Lett., vol. 29, no. 5, pp. 477-478, 1993.

[2] A. M. Vengsarkar, P. J. Lemaire, G. Jacobovitz Veselka, V. Bhatia, and J. B. Judkins, "Long-period fiber grating as gain-flattening and laser stabilizing devices," in Pro. IOOC '95, Hong Kong, vol. 5, PD1-2, 1995.