L-band Power Enhancement through the reinsertion of backward ASE filtered by a C/L-band coupler

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Erbium doped fiber (EDF) sources are useful devices for characterization of optical components for wavelength division multiplexing (WDM) fiber optic communication system. Therefore, there are many efforts to extend the bandwidth and to increase the power of the light source. Especially, L-band ASE source uses the low inversion state of EDF. It makes the power efficiency very low and needs a lot of fiber as several times as the fiber needed in C-band ASE generation. Thus, several methods have been reported to increase the efficiency and reduce the necessary length of high cost EDF [1-3]. Among them, one using unpumped EDF section or an optical mirror at the front-end has been proposed as the effective ways [1-2]. But both of the cases have their own drawbacks; one uses high-cost unpumped EDF section and the other consumes amount of pump power due to the C-band ASE.

In this letter, we have proposed a new structure making more efficient L-band ASE generation utilizing a C/L-band coupler, an optical mirror and a FBG without the need of an additional unpumped EDF section or the pump power reduction due to the reinsertion of the full C-band ASE. The output spectra for several structures have been also measured and analyzed.

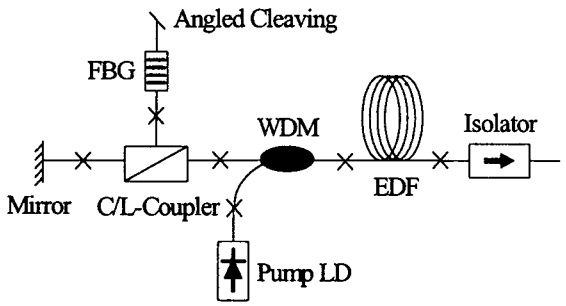

Fig 1 Proposed structure

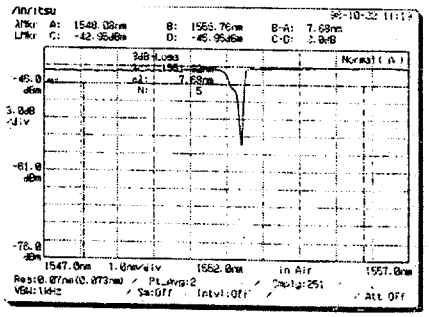

Fig. 2 Spectrum of FBG

The experiments were performed for 4 structures. The First structure (Str 1) is the proposed one like Fig.1. The second one (Str 2) is a general structure using only an optical mirror at a signal port of WDM. The third one without a FBG (Str 3) is for demonstrating the effect of L-band small seed signal. The last one without a mirror (Str 4) is for investigating additional pumping effect of the filtered C-band ASE. GP980 EDF (50 m) from OFS and 980 nm pump LD

(80 mW) were used. The reflectivity and the center wavelength of FBG are about 95% and 1552.4 nm respectively as shown in Fig. 2. And an optical mirror is used as a broadband reflector

In the proposed structure,, a C/L-band coupler is adopted to divide backward ASE into 2 parts such as C-band and L-band ASE. In the C-band branch of C/L-band coupler, the FBG is connected to select the special wavelength light and in the L-band branch, the optical mirror is attached to reflect the whole L-band ASE. The L-band light reflects from the optical mirror and reinserts into EDF while the C-band one meets FBG and the only reflected light redirected into EDF. Thus, the L-band ASE plays as a seed beam and the filtered C-band ASE as a pump light.

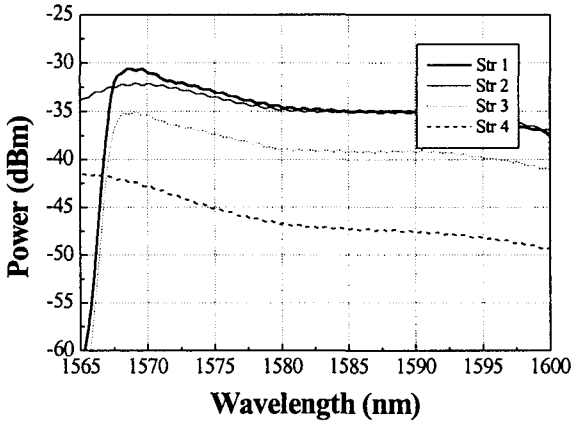

Fig. 3 Spectra from 4 structures

Fig. 3 shows the results for 4 structures. The proposed structure has about 1.5 dB increase of the power around 1570 nm. It's from the truth that if the C-band and L-band ASE go through EDF, together, C-band light can get the more gain than L-band light due to the relatively large gain coefficient in C-band region and that the unwanted C-band light consumes many parts of the pump power which is necessary for the L-band ASE generation. It's the main reason that makes the efficiency in the L-band ASE generation low. In the proposed structure, however, most of C-band ASE is filtered through FBG, and the L-band ASE is reinserted into EDF as the seed beam.

We shows a possibility that a cost-effective L-band light source can be easily achieved without using expensive dummy unpumped EDF section and that the proposed structure is more efficient than methods which use an optical mirror or a FBG. In addition, the efficiency of this structure can be improved through an optimizing process of the center wavelength and reflectivity of FBG, and the length of EDF. Futher studies to achieve higher efficiency are being pursued by the authors.

References

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