C+L band light sources based on Bi / Er / La co-doped silica fibers

Longzhao Zeng, Jianxiang Wen, Lei Yang, Yan Wu, Yanhua Dong, Xiaobei Zhang, Sujuan Huang, Fufei Pang*

Key Laboratory of Specialty Fiber Optics and Optical Access Networks, Joint International Research Laboratory of Specialty Fiber Optics and Advanced Communication, School of Communication and Information Engineering, Shanghai University, 99 Shangda Road, Shanghai 200444, China

Author e-mail address: wenjx@shu.edn.cn

Introduction

We designed C+L band light sources with Bi/Er/La co-doped silica fibers. The broadband one had fluorescence intensity of -21.00 dBm in 1529-1607 nm, and the different-wavelength lasers were generated.

Properties

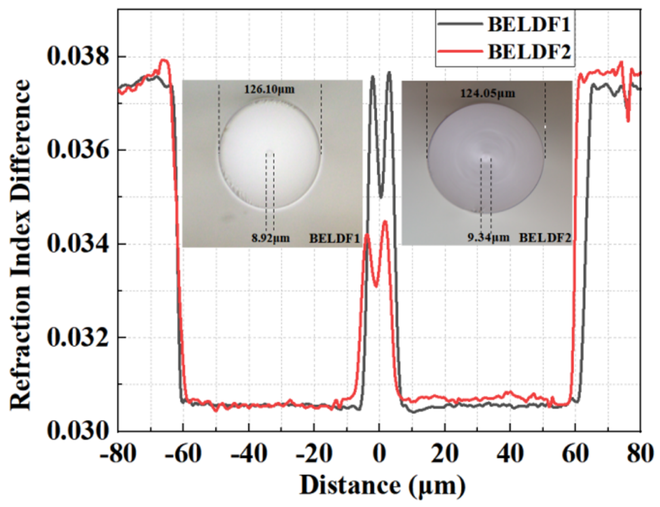

Figure 1. Refractive index distribution of BELDF1 and BELDF2. Inset: cross-section view.

Table 1. The properties of two BELDFs

Fiber samples	BELDF1	BELDF2
Core diameter	8.92 μm	9.34 μm
Cladding diameters	126.10 μm	124.05 μm
Refractive index difference	0.0071	0.0040
Absorption （dB/m）	13.27 @ 978nm	10.06 @ 977 nm
	19.05 @ 1535 nm	30.23 @ 1529 nm

Two different BELDFs, BELDF1 and BELDF2, were both fabricated by modified chemical vapor deposition combining with atomic layer deposition technology. The properties of two fibers are shown in Fig.1 and Table 1.

Experimental Setup

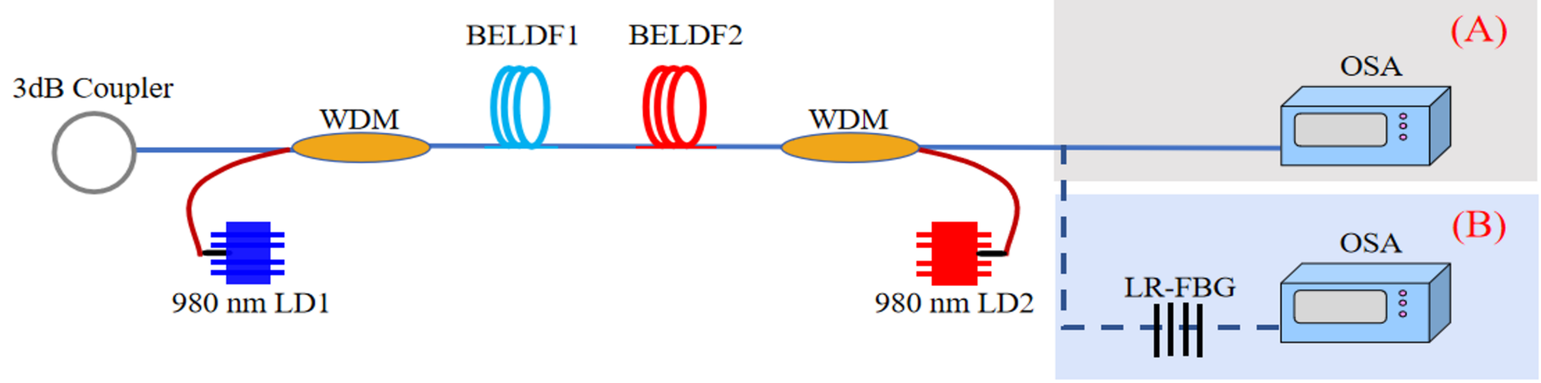

Figure 2. Experimental system of (A) C + L band light source and (B) laser.

We designed a two-stage dual-pump structural C+L band light source, as shown in Fig. 2 (A). The experimental system consists of two laser diodes (LDs) with the operating wavelength of 980 nm, two wavelength division multiplexers (WDMs), two different BELDFs, a 3 dB coupler, and an optical spectrum analyzer (OSA).

Based on the experimental system of the C+L band light source, different-wavelength lasers system were established by adding a kind of low reflectivity (60%) fiber Bragg grating (LR-FBG) with different central wavelengths, as shown in Fig. 2 (B). In the experiment, the 3 dB coupler and the LR-FBGs formed a linear cavity to obtain laser output with different wavelengths.

Experimental Results

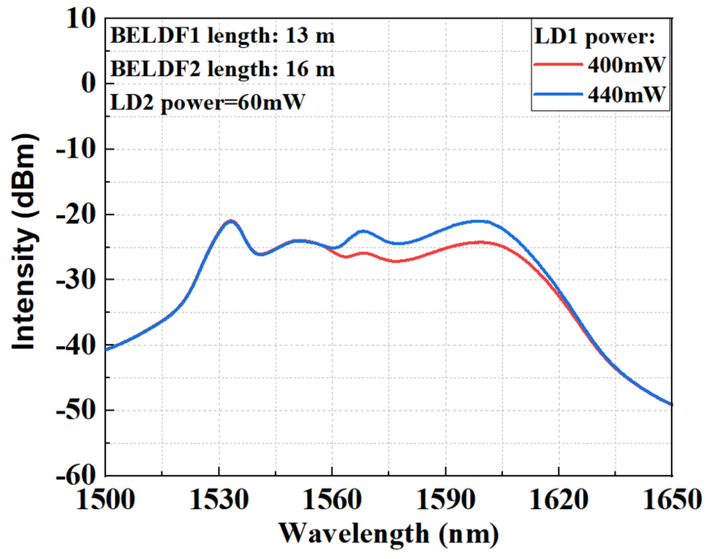

Figure 3. Output spectrum of light source in C+L band.

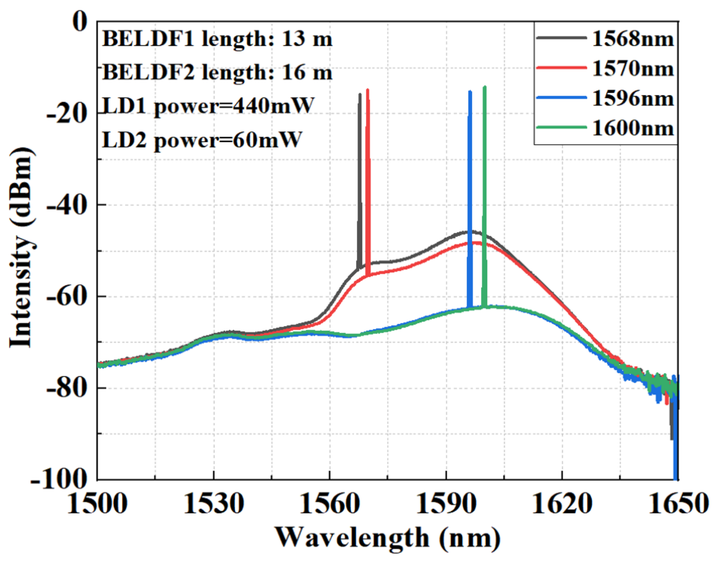

Figure 4. Laser output spectra of different wavelengths.

The lengths of BELDF1 and BELDF2 were fixed as 13 and 16 m, and the powers of LD1 and LD2 as 440 and 60 mW. As shown in Fig. 3, the intensity of output fluorescence is -21.00 dBm, and the 3 dB bandwidth is 78 nm (1529-1607 nm).

In addition, FBGs with the central wavelengths of 1568±0.3, 1570±0.3, 1596±0.3, and 1600±0.3 nm were chosen in the experiment system. The output spectra were recorded, as shown in Fig. 4. The output power of lasers are 4.33, 4.42, 5.44, and 5.76 mW at 1568, 1570, 1596, and 1600 nm, respectively.