Journal of the Optical Society of Korea
Vol. 18, No. 2, April 2014, pp. 162-166

ISSN: 1226-4776(Print) / ISSN: 2093-6885(Online)
DOI: http://dx.doi.org/10.3807/JOSK.2014.18.2.162

Impact of Booster Section Length on the Performance of Linear Cavity Brillouin-Erbium Fiber Laser

Thamer Fahad Al-Mashhadani[1], Md Zaini Jamaludin[2], Mohammed Hayder Al-Mansoori[3], Fairuz Abdullah[2]*, and Abdulla Khudair Abbas[2]

[1]Department of Electrical Engineering, Tikrit University, Salahuddin, Tikrit, P.O. Box 42, Iraq
[2]Center for Photonic Technologies, College of Engineering, Universiti Tenaga Nasional, Jalan IKRAM-UNTIEN, 43000 Kajang, Selangor, Malaysia
[3]Faculty of Engineering, Sohar University, P.O. Box 44, Al Jameah St, Sohar 311, Oman

(Received July 18, 2013 : revised February 25, 2014 : accepted February 26, 2014)

The impact of booster section length made from passive erbium-doped fiber (EDF) on the L-band multiwavelength Brillouin-Erbium fiber laser (MBEFL) is studied experimentally in this paper. The influence on the performance of MBEFL in term of number of generated Stokes lines, tuning range and lasing threshold were investigated. A comparison was made between MBEFL without a booster section and with booster sections of different lengths. Through comparative study and at fixed BP power and 100mW of 1480 pump power, longer passive EDF length of 5m exhibits the highest average number of Stokes lines of 23 with tuning range of 14nm. In contrast, shorter passive EDF length of 1m shows the highest tuning range of 17nm and an average number of 21 Stokes lines.

Keywords : Booster section, Brillouin-Erbium fiber laser, Fiber laser, Linear cavity laser
OCIS codes : (140.3460) Lasers; (140.3500) Laser, erbium; (140.3510) Lasers, fiber; (140.3410) Laser resonators

I. INTRODUCTION

Multiwavelength Fiber laser (MFL) has been the focus of many researchers in the last two decades due to its potential application in dense wavelength division multiplexing (DWDM) communication systems [1], optical sensors [2] and spectroscopy [3]. Since then, numerous works have been reported where the aim is to improve lasing threshold, number of generated Stokes lines and tuning range [4, 5]. One method is to use high Brillouin pump (BP) where it can result in increasing the tuning range. However, the downside of this method is that it will reduce the number of generated Stokes signals. This happens because high BP will saturate the Erbium-doped fiber (EDF) gain faster [6]. Another method to enhance tuning range is by using a band pass filter and Sagnac loop mirror [7-10]. However, the filter limits the gain bandwidth thus reducing the number of generated Stokes signals and the Sagnac loop added complexity to the set up with similar output. A virtual mirror is another technique to enhance tuning range by reducing the competition with BP power through suppressing the self-lasing cavity modes again at the expense of the number of generated Stokes lines [11, 12].

Increasing the number of the Stokes line generation was another goal of many researchers [13-15]. A simple and efficient method to increase the number of generated Stokes lines was proposed by [16] insering a short length of passive EDF into the cavity. Using this technique, the number of generated Stokes lines was increased by 33% because the passive EDF section acts as an additional gain medium pumped by backward amplified spontaneous emission (ASE) from active EDF in the cavity. However, increasing the generated Stokes lines due to the inclusion of a single passive EDF booster section length was the main idea investigated in [16]. So far no passive EDF section length optimization was presented. In addition other laser cavity performance of tuning range and laser

*Corresponding author: fairuz@ieee.org
Color versions of one or more of the figures in this paper are available online.