Stimulated Brillouin Scattering for Multiwavelength Bismuth Doped Fiber Laser in 1.3 μm

M Z Samion[1], H Ahmad[1,2], M K A Zaini[1], and L Bayang[1]

[1]*Photonics Research Centre, Universiti Malaya, Kuala Lumpur, Malaysia*
[2]*Department of Physics, Faculty of Science, Universiti Malaya, Kuala Lumpur, Malaysia*
Contact Email: zarifzf@um.edu.my

Stimulated Brillouin scattering (SBS) is a nonlinear phenomenon that occurs in optical fibres when an intense incident light interacts with acoustic waves, resulting in a frequency change of the incident light, also known as Stokes light. Because of the cascading Brillouin effect, multiple Stokes lines can be created. As lower-order Stokes lines spread and are amplified by a gain medium in the laser resonator to surpass the SBS threshold, higher-order Stokes lines are formed.

Various multi-wavelength fiber lasers based on SBS have been demonstrated at the 1550 nm wavelength region. However, the increasing demands for bandwidth have made recent research efforts focus on extending the operating wavelength into neighboring regions, particularly in the wavelength region of 1310 nm or more commonly known as the O-band region. Although there have been several reports on the multi-wavelength Brillouin fiber lasers in this region, they are either based on semiconductor optical amplifiers (SOAs) [1], or they are utilizing the ring cavity with complex design such as the hybrid configuration [2]. However, there is still no demonstration of a PDFF based multi-wavelength Brillouin fiber laser in a linear cavity configuration.

In this report, to the best of our knowledge, this is the first demonstration of a multi-wavelength bismuth-doped fiber laser utilizing the stimulated Brillouin scattering. The multi-wavelength fiber laser operates in the 1.3-μm region, complementing the existing multi-wavelength fiber laser sources in the 1550 nm wavelength region. The Brillouin pump was first set at a center wavelength of 1314 nm, with an optical power of 11 dBm. A maximum number of 13 significant Brillouin Stokes lines with an approximately 0.074 nm spacing were generated at a pump power of 1021 mW. The multi-wavelength laser is tunable across a wavelength span of 20 nm, ranging from 1305 to 1325 nm. The laser has the potential to be used as a laser source for dense wavelength division multiplexing, providing an alternative to support larger bandwidth demand in the communication system.

References

[1] A Hayder and L R Chen, in LEOS 2007 - IEEE Lasers and Electro-Optics Society Annual Meeting Conference Proceedings, Institute of Electrical and Electronics Engineers, Florida, 2007, pp. 92

[2] H Ahmad, S N Aidit and Z C Tiu, Opt. Laser Technol. **99**, 52 (2018)