Enhanced flatness of 20 Ghz channel spacing multiwavelength Brillouin-Raman fiber laser with sub-millimeter air gap

ABSTRACT

We discover the technique of controlling the flatness in signal amplitude of a multiwavelength Brillouin-Raman fiber laser by employing an air-gap outside of the cavity. The structure that is adjustable within sub-millimeter length behaves as flexible optical feedback that provides modifiable portions of multiple Fresnel reflectivities. This is the main benchmark that allows the efficient management of gain competition between self-lasing modes and Brillouin Stokes waves that is vital for self-flattening initiation. When setting the Brillouin pump wavelength at 1529 nm and the air-gap distance to 0.4 mm, 296 Stokes lines are produced with a channel spacing of 0.158 nm. The lasing bandwidth is 46.60 nm that covers from 1529.16 to 1575.76 nm wavelength. In this case at Raman power of 950 mW, the intense Brillouin pump power of 2 dBm saturates the cascaded higher-orders lasing lines. As a result, the overall peak power discrepancy is maintained at just 1.8 dB where an average optical-signal-to-noise ratio of 20 dB is realized. To date, this is the widest bandwidth with the flattest spectrum attained in multiwavelength fiber lasers that incorporate a single Raman pump unit.

Keyword: Multiwavelength Brillouin-Raman; Fiber laser; Air gap