Switchable Dual-Wavelength Thulium-Doped Fiber Laser Implementing a Multi-Cavity Fabry-Pérot Filter

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In recent years, have been designed and demonstrated a novel type of configuration that has allowed the emission of multiple wavelengths in all fiber-optics systems implementing a spectral filter called multi-cavity Fabry-Pérot interferometers (MFPI), whose composition relies on several in-fiber air microcavities that modify the spectral reflection response of a Fabry-Pérot interferometer (FP). In this sense, the background within our research group has allowed implementing a MFPI for the generation of multiple wavelengths in the region of 1550 nm [1] and 1900 nm [2]. With the objective to improve the spectral response of the MFPI in the 2 μm spectral region, we made a different type of structure of MFPI composed of a union of microfiber with a commercial Single Mode Fiber (SMF).

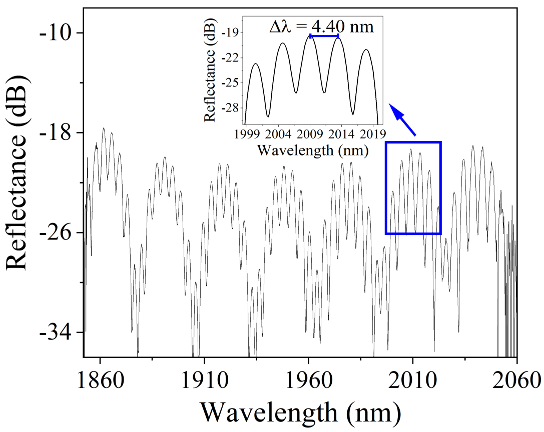

Figure 1: MFPI reflectance spectrum, the inserted image shows a few periods of the filter's sinusoidal response

In this work, a switchable dual-wavelength thulium-doped fiber laser implementing a multi-cavity Fabry-Pérot filter (MFPI) is presented. The MFPI is constituted through a microfiber structure spliced to a standard SMF-28 fiber section. The interferometer is based on two areas of collapse consisting of the coating material, which provides a filtering response that allows the laser to operate in a dual-wavelength emission regime at 2009.20 and 2013.65 nm. In addition, the laser is capable of switching between both laser lines by adjusting the polarization settings, obtaining the ability to operate in a single wavelength regime in the region of 2009 or 2013 nm. The laser output possesses a 3-dB laser linewidth of around 50 pm, a signal-to-noise ratio higher than 50 dB, a maximum output power of 13.36 mW and high temporal stability, a maximum wavelength and peak power fluctuations were measured as $\pm$160 pm and $\pm$4.38 dBm, respectively, for a period of time of 1 hour. This configuration, as far as we know, is the first configuration capable of producing laser emission lines above 2000 nm using an MFPI that implements a microfiber-based structure.

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References

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