

Thulium-Doped Fiber Laser with Tunable Single Emission and Dual-Wavelength Generation Near to 2 μm

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Thulium-doped fiber lasers (TDFL) have been of recent interest because of their potential applications in diverse areas such as remote sensing, bio-medical treatment, and optical instrumentation. Nowadays, investigations on TDFL operating in the eye-safe 2 μm spectral region have been increased due to their operation characteristics of good beam quality, wide waveband tuning, and high nonlinear threshold. From our previous work on fiber lasers at the 1.55 μm region, we have demonstrated the use of the fiber optical loop mirror with high birefringence fiber in the loop (Hi-Bi FOLM) as a trustworthy optical device to adjust the cavity losses for dual-wavelength generation [1], and lately for single laser wavelength selection and tuning [2].

In this work we report a linear cavity Thulium-doped fiber laser with single tunable wavelength emission and dual-wavelength generation near to 2 μm . The single wavelength tuning and the dual-wavelength cavity losses adjustment is achieved by performing temperature changes in the high birefringence (Hi-Bi) fiber loop of a fiber optical loop mirror (FOLM). An experimental analysis of the TDFL performance characteristics as a function of the Thulium-doped fiber (TDF) length is presented. Experimental results for dual wavelength generation as a function of the TDF ASE+ spectrum for TDF lengths of 12, 8, 4 and 2-m are shown (Figure 1(a)). TDFL results of single line emission with wavelength tuning in a range of ~ 40 nm and dual-wavelength laser generation (at single laser wavelength tuning limit)s with wavelengths separation of ~ 50 nm are discussed (Figure 1(b)) for each TDF fiber length. The wavelength range in which single wavelength laser emission is generated and the dual-wavelength generation in terms of the TDF ASE+ spectrum and the Hi-Bi FOLM wavelength period of ~ 55 nm are also discussed based on the experimental results. We propose the use of the Hi-Bi FOLM as a simple, trustworthy, and

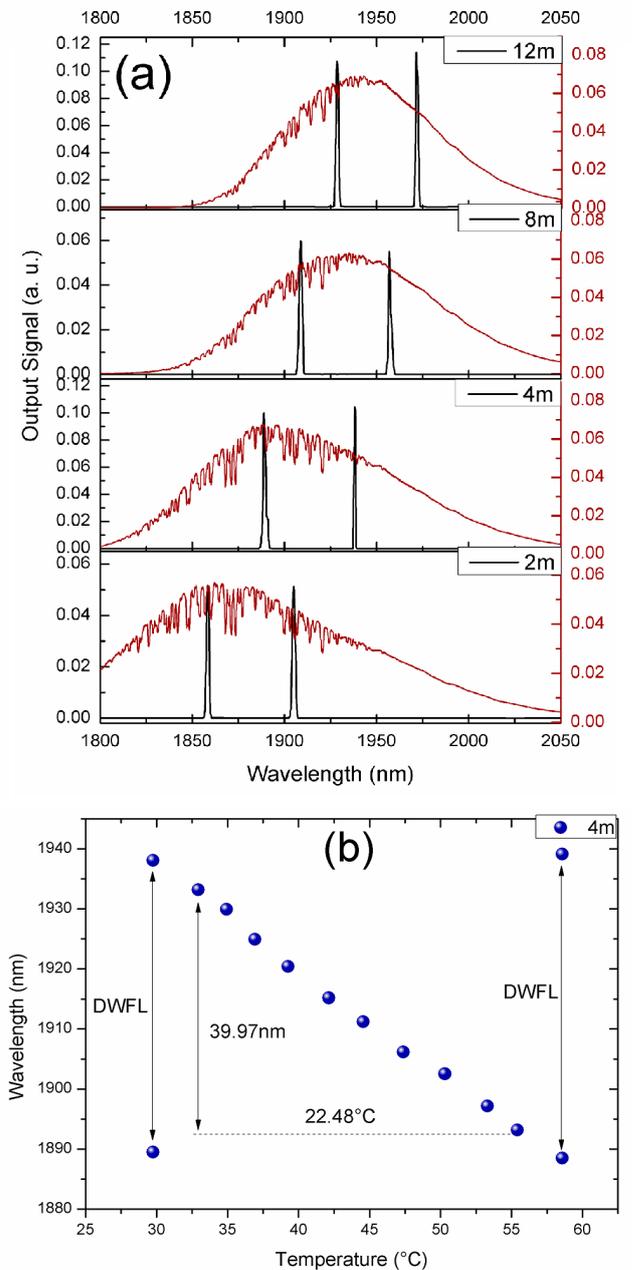


Figure 1: (a) Dual wavelength laser generation and TDF ASE+ spectra for different TDF lengths, (b) TDFL performance as a function of the Hi-Bi FOLM fiber loop temperature with 4-m of TDF length

straightforward method for single wavelength tuning and dual-wavelength laser generation for TDFLs operating near to the 2 μm wavelength region.

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References

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