Tunable Dual-Wavelength Actively Q-Switched Er/Yb double-clad fiber laser

M. Durán-Sánchez[*a], *E. A. Kuzin*[b], *O. Pottiez*[d], *B. Ibarra-Escamilla*[b], *A. González-García*[b,c], *F. Maya-Ordoñez*[b] *and R. I. Álvarez-Tamayo*[a]

[a]*Mecatrónica, Universidad Tecnológica de Puebla, Ant. Camino a la Resurrección N°1002-A Parque Industrial, Puebla, Pue.72300, México, tel, +52 2223098850*

[b]*Departamento de Óptica, Instituto Nacional de Astrofisica, Óptica y Electrónica, Luis Enrique Erro No. 1, Puebla, Pue. 72000, México, tel/fax +52 2222472940*

[c]*Instituto Tecnológico Superior de Guanajuato, Carretera Estatal Guanajuato-Puentecillas, C.P. 36262, Guanajuato, Gto. México*

[d]*Centro de Investigaciones en Óptica, Fiber Optics Department, Lomas del Bosque N. 115, León, Gto. 37150, México, tel +52 4774414200 ext 288, fax +52 4774414209*

e-mail: maratonista80@hotmail.com, mdurans.utp@gmail.com[*]

We report a tunable dual wavelength actively Q-Switched Er/Yb double-clad (EYDF) fiber laser by using a polarization maintaining fiber Bragg grating (PM-FBG) in a Fabry-Perot configuration. The PM-FBG was mechanically compressed/stretched allowing a total wavelengths tuning range of ~12nm with a peak separation of ~0.25-0.45nm. Without compression/stretch the PM-FBG is centered at 1549nm with 99.5% reflection. The cavity includes a polarization controller (PC) which allows adjusting cavity losses for stable single- and dual-wavelength Q-switching operation. Pulses are successfully achieved up to the repetition rate of 100 kHz. The gain medium of the laser is a 3-m EYDF with Yb^{3+} and Er^{3+} concentrations of $N_{Yb} = 1.2\times10^{26}$ m^{-3} and $N_{Er} = 1.0\times10^{25}$ m^{-3} respectively. The laser is Q-switched by a fiber acousto-optic modulator. The spectrum of the dual wavelength fiber laser over the whole tuning range is shown in Fig. 1a. Fig. 1b shows the Q-switched pulses filtered by the monochromator with resolution of 0.1nm at 1549.17nm (blue line) and 1549.54nm (red line), which correspond to the dual wavelengths shown in Fig. 1a (black line). The black line in Fig. 1b shows the inverted modulation pulse. Fig. 1c shows the temporal displacement of the Q-switched pulses within the modulation window due wavelength tuning. When we are applying compression to the PM-FBG we can observe that the pulses get shorter, and when we apply a stretching the pulses widen. As can be seen near to Δλ=6nm, the pulses temporal position begin to stabilize around 1.6μs because this value is close to the minimum delay time of Q-switching.

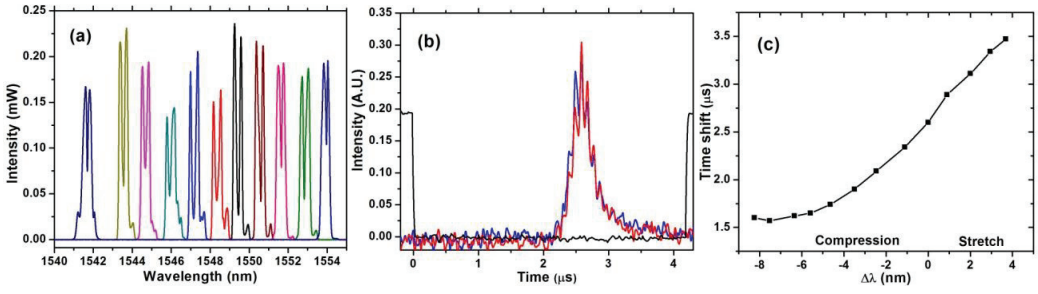

Fig.1 Experimental results of tunable dual wavelength Q-switched fiber laser. (a) Spectrum measured by OSA with 10 pm resolution, (b) Pulse waveform, (c) Pulse temporal position versus wavelength displacement respect to 1549nm.

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