Measurement of the characterization of a passively mode-locked fiber ring laser

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Abstract:
We set up a passively mode-locked fiber ring laser to generate stable and self-starting short pulses, with pulse width at microsecond order. We use a 980 nm laser diode to pump the erbium-doped fiber to generate the light nearby 1550 nm. A polarization dependent isolator and two fiber polarization controllers are used to introduce the polarization additive-pulse mode-locking mechanism in this structure using the nonlinear polarization rotation of light. Two distinct regimes of mode-locked operation are observed that depend on the pump power from 75 mW to 175 mW. When the pump power is over 160 mw, its spectrum has symmetrical side lobes and it is called in a Q-switched regime. On the other hand, it will have an approximately sech^2 spectrum and it is called in a soliton regime. By varying the cavity length and the polarization controller's settings, we could also observe the variation of pulse width.
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Experimental Setup:

By adjusting the polarization controller at appropriate settings and the pump power at 132mW, we can get laser pulse trains for the 5m ,10m and 20m Er-doped fibers, respectively.

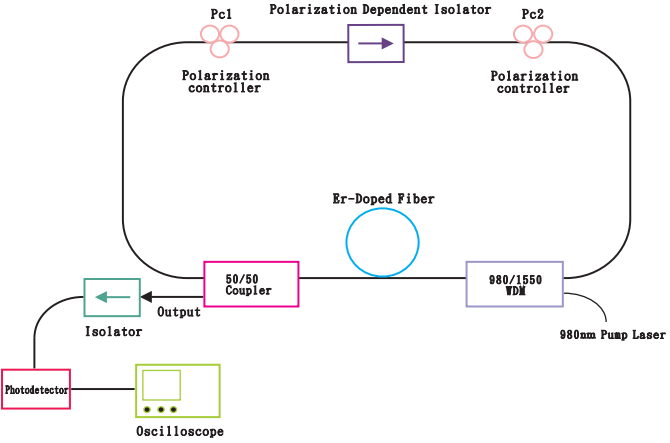

Fig.1. Experimental system configuration : PC, polarization controller. WDM, wavelength division multiplexer.

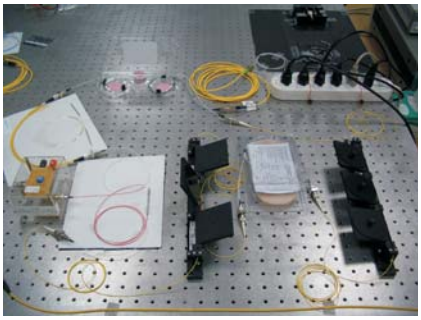

Fig.2. Experimental system picture.

Experimental results:

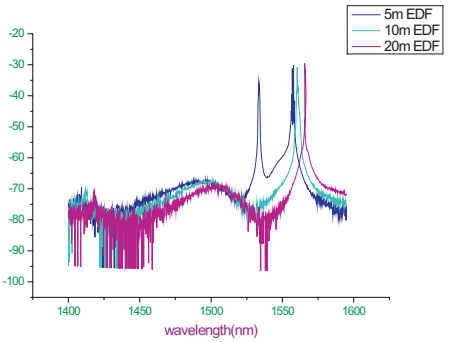

Fig.3. Laser output spectra for 5m EDF, 10m EDF and 20m EDF.

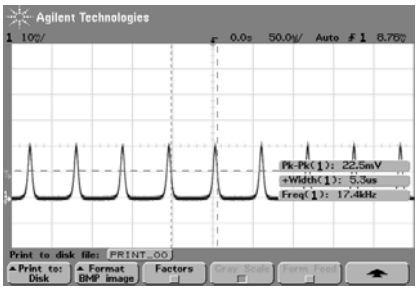

Fig.4.(a) 5m EDF pulse train (pump power 132mW).

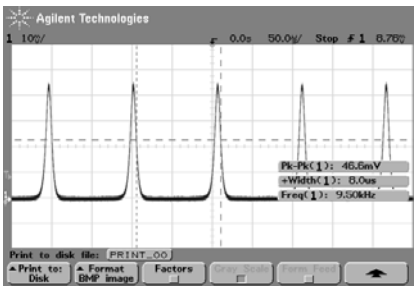

Fig.4.(b) 10m EDF pulse train (pump power 132mW).

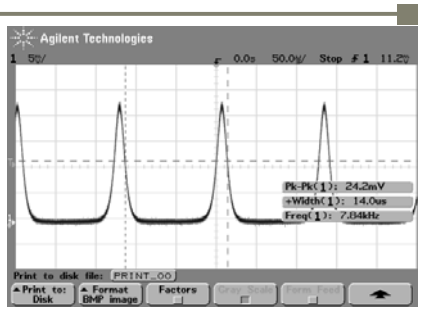

Fig.4.(c) 20m EDF pulse train (pump power 132mW).

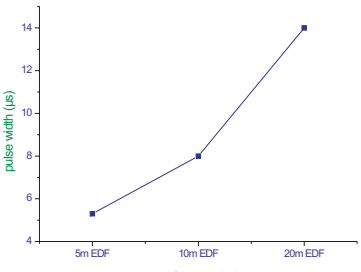

Fig.5.(a)

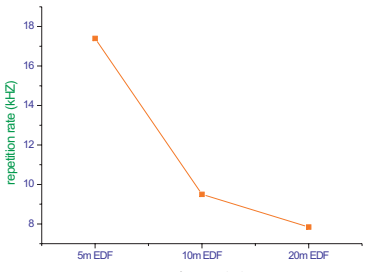

Fig.5.(b)

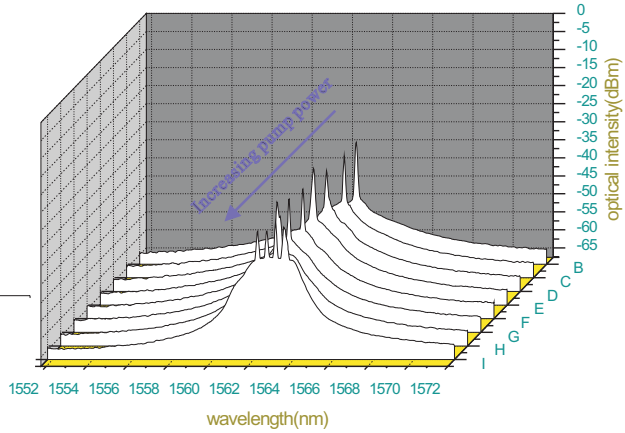

Fig.6. Optical spectrum variation with increasing pump power(75mW, 89mW, 104mW, 118mW, 132mW, 146mW, 160mW, 175mW). The length of the Er-doped fiber is 10m.

References:
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