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Raman Scattering Broadband Spectrum Generation in Compact Yb-Doped Fiber Laser

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Abstract : Nonlinear polarization rotation (NPR) technique has become one of the main techniques to achieve mode-locked fiber lasers for its compactness, implementation, and low cost. In this paper, we demonstrate a compact mode-locked Yb-doped fiber laser based on NPR technique in the all normal dispersion (ANDi) regime. In the laser cavity, there are no physical filter and polarization controller in laser cavity. Mode-locked pulse train is achieved in ANDi regime based on NPR technique. The fiber birefringence induced filtering effect is the mainly reason for mode-locking. After that, an extra 20 m long single-mode fiber is inserted in two different positions, dissipative soliton operation and noise like pulse operations are achieved correspondingly. The nonlinear effect is obviously enhanced in the noise like pulse regime and broadband spectrum generated owing to enhanced stimulated Raman scattering effect. When the pump power is 210 mW, the central wavelength is 1030 nm, and the corresponding 1st order Raman scattering stokes wave generates and locates at 1075 nm. When the pump power is 370 mW, the 1st and 2nd order Raman scattering stokes wave generate and locate at 1080 nm, 1126 nm respectively. When the pump power is 600 mW, the Raman continuum is generated with cascaded multi-order stokes waves, and the spectrum extends to 1188 nm. The total flat spectrum is from 1000nm to 1200nm. The maximum output average power and pulse energy are 18.0W and 14.75nJ, respectively.

Keywords : fiber laser, mode-locking, nonlinear polarization rotation, Raman scattering
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