Tunable Highly Chirped Dissipative Soliton Erbium Fiber Source

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Fiber lasers have become an important and useful tool for different applications in many spheres of life. That is why the creation of powerful ultrafast light source is very demanded Ultrafast fiber lasers are a suitable platform for such source development because of their compactness, absence of sensitive adjustments and high quality of the output beam.

Here we present a fiber source that can generate pulses with high energy and linear chirp. Our source consists of a master oscillator and fiber chirped-pulse amplifier. Master oscillator is a fiber laser based on the highly chirped dissipative soliton generation in normal net cavity dispersion. The laser cavity exploits the spatial division of the mode-locking and soliton formation sections techniques, where mode-locking takes place in a relatively short single-mode fiber piece via nonlinear polarization evolution effect. Such an approach allows changing the length and configuration of the cavity without effect on the mode-locking process. To generate HCDS, several requirements should be fulfilled: normal net cavity dispersion and the presence of strong spectral filtration. A combination of bulk reflective diffractive grating and double fiber collimator can produce a parabolic spectral shape of the filter which was used in a master oscillator. The additional feature of the filter was a possibility to change the central wavelength of the generated pulses via relative grating and collimator relative angle adjustment (see Fig. 1). As a result, 2.5 nJ HCDSs were obtained with a repetition rate at 6.7 MHz.

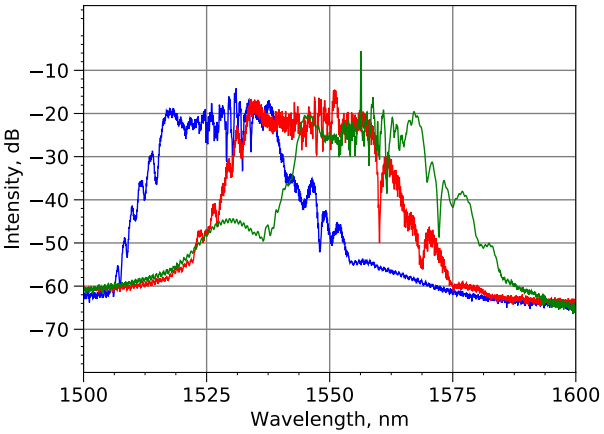

Figure 1: Demonstration of tunability of the generated HCDS spectra via filter adjustment

Generated pulses were additionally stretched in normal PM fiber and amplified with a commercial fiber device. Amplified pulses were characterized with optical spectra and frequency-resolved optical gating (FROG) traces in terms of phase and pulse duration. Maximum amplified energy was 24 nJ, which is limited by nonlinear distortions.

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