

Wideband Ultrashort Pulse Fiber Lasers and Their Applications

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Passively mode-locked fiber lasers are stable and practical ultrashort pulse laser sources. Recently, nano-carbon materials absorb a lot of attentions as a useful mode-locker. So far, we have been investigating the highly functional ultrashort pulse fiber laser sources and their applications [1,2]. In this talk, we present our recent progress about our research, mainly on the optical frequency comb.

Figure 1 shows the optical spectra of octave spanning coherent supercontinuum (SC) comb. We developed stabilized Er-doped fiber laser comb system. Then the output pulse was amplified with similariton amplifier, and 1.0 – 2.0 μm octave spanning coherent SC comb was generated with highly nonlinear fiber. Compared to the other SC, the generated SC comb has high flatness and smoothness, and high coherence and low noise properties [2].

We also developed wideband wavelength tunable comb source using nonlinear fiber techniques, as shows in Fig. 2. It can be tuned continuously and arbitrary. The high coherent was also confirmed.

Optical frequency comb at MIR region is important for the application of spectroscopy. We developed MIR comb system based on ultrashort pulse fiber lasers. Figure 3 shows the optical spectra of generated MIR comb. A passively mode-locked Yb doped fiber laser with repetition frequency of 180 MHz was developed. The output pulse was amplified, and MIR comb was generated through DFG between 1.04 μm and 1.35 μm components. The high coherence was confirmed with RF beat measurement with QCL [3].

References 1. N. Nishizawa, Jpn. J. Appl. Phys. 53, 090101 (2014) , 2. N. Nishizawa, et al, IEEE J. Sel. Top. Quantum Electron. **24**, 5100409 (2018), 3. L. Jin, et al, IEEE J. Sel. Top. Quantum Electron. **24**, 0900907 (2018)

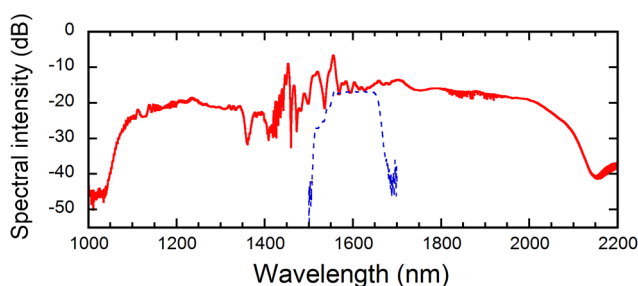


Fig. 1. Optical spectra of wideband SC comb

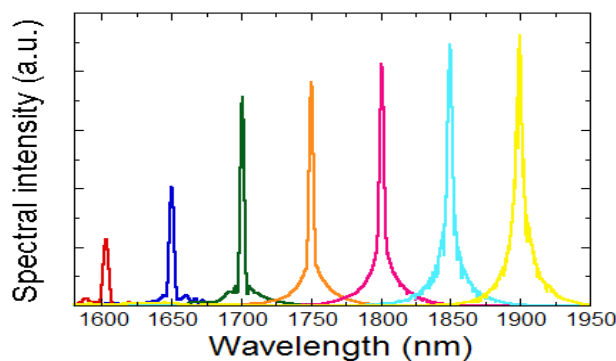


Fig. 2. Optical spectra of wavelength tunable comb

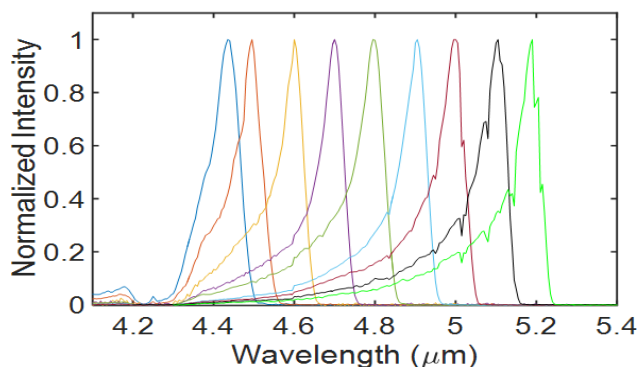


Fig. 3. Optical spectra of wavelength tunable MIR comb