Study of the CW laser amplification properties of the Fe:ZnSe crystal at mid-IR band

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Solid-state lasers operating in the 3-5 μm mid-infrared region have attracted enormous interest over the past decade due to their potential applications in molecular spectroscopy and laser processing. Benefiting from the high gain cross-section and broad gain bandwidth of the Fe:ZnSe crystal, it has been shown to be capable of highly efficient CW laser oscillation [1], Q-switched operation [2] and mode-locked operation [3] with broad emission tunability. Very recently, a room temperature Fe:ZnSe laser amplifier generating 3.5-mJ 150-fs femtosecond pulses at ~4.4 μm has been reported [4]. The amplifier scheme is capable of amplifying the signal laser intensity while maintaining the originally spectral property and beam quality. It is worth noting that the higher gain and longer fluorescence lifetime of the Fe:ZnSe at cryogenic temperature make it possible to efficiently amplify the CW laser signal, which has not been studied yet.

In the meeting, we will present the CW laser amplification properties of the high quality Fe:ZnSe crystals. The schematic diagram of the laser amplifier is shown in Fig. 1. A home-constructed 2.92-μm Er:YAP laser served as the pump source of the Fe:ZnSe. The seed light was provided by a commercially available, single-mode quantum cascade laser emitting at ~4 μm. Detailed amplification properties were studied for different signal power and lasing spectra. The results indicate that the cryogenically cooled Fe:ZnSe crystal could be a promising gain element for the CW laser amplifier at 4-5 μm wavelength band.

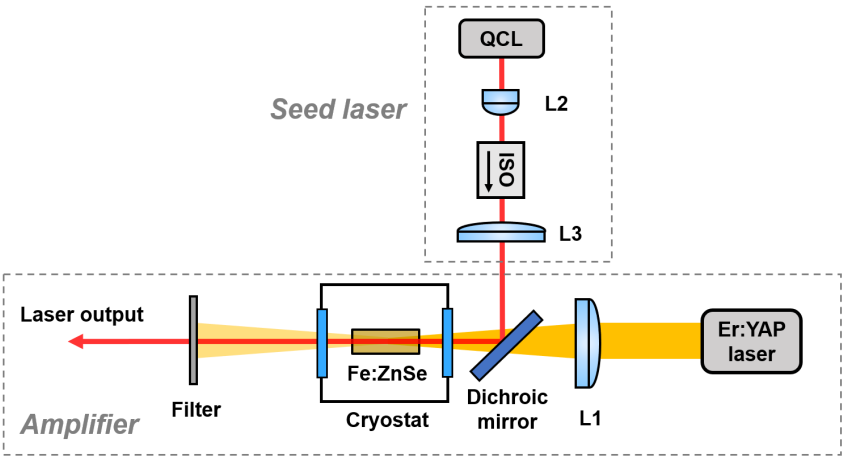

Fig. 1. Schematic diagram of the CW Fe:ZnSe laser amplifier.

References

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