1. INTRODUCTION

Continuous wave lasers at 1.6 µm are useful for a variety of remote sensing applications, including the measurement of wind-field velocities using eye-safe coherent laser radar [1, 2]. Crystals with Er³⁺ doping are attractive active materials for such developments [3, 4]. YAG is an excellent host for Er lasers [5–7].

Er:YAG lasers that oscillate at 1.6 µm can be resonantly pumped at either 1532 nm using an erbium doped fiber laser (EDFL) [8–10] or at 1470 nm using laser diodes [11, 12]. Recently, much attention of researchers was devoted to development of Er:YAG lasers [13]. The first resonantly pumped Er:YAG laser operating at the 1.64 µm was demonstrated at 77 K by Killinger et al. in the 1980’s. In the 1990’s Spariosu and Birnbaum reported such a laser operating at room temperature and then intracavity [14]. The highest output power of 1.6 µm was 60.3 W reported by Kim et al. in 2009 [15]. Yang et al. reported a 11 W polycrystalline Er:YAG ceramic laser in-band pumped by a fiber laser at 1532 nm in 2011 [16].

In this letter, we reported a Er:YAG laser with double etalons under room temperature, 1645.1 and 1617.2 nm wavelength were obtained by regulating the angle of the two etalons. 350 mW of 1645.1 nm, 160 mW of 1617.2 nm output were achieved under total incident pump power of 7 W.

2. EXPERIMENTAL SETUP

The experimental setup was shown in Fig. 1. The 40 mm long, 4 mm diameter laser rod was doped with 0.3 at% of Er. The laser crystal was mounted in a copper heat sink maintained temperature of 17°C with thermoelectric cooler (TEC). The pumped source was MgO:PPLN at wavelength of 1532 nm. The diameter of the pump-beam was focused to 98 µm. A plano-concave geometry comprising a plane pump input coupler with high transmission (>95%) at the pump wavelength (1.5 µm) and high reflectivity (>99%) at the lasing wavelength (1.6 µm) was used. The output coupler was coated for 3.5% transmission at 1.6 µm with 150 mm radius of curvature. The physical cavity length was approximately 100 mm. Two quartz etalons (0.15 and 0.5 mm in thickness) with no coating were inserted in the cavity to select the wavelength of the Er:YAG laser.

![Fig. 1. Experimental setup of the Er:YAG laser with double F–P etalons.](image-url)
3. EXPERIMENTAL RESULTS

In the experiment, the output wavelength of Er:YAG laser was recorded with a spectrum analyzer (WA-650, EXFO) combined to a wave meter (WA-1500, EXFO), the power meter used was Coherent PM30. The free running spectrum of Er:YAG laser at 1645 and 1617 nm was shown in Fig. 2.

1645.1 and 1617.2 nm wavelength were obtained by regulating the angle of the two etalons as shown in Figs. 3 and 4.

The maximum output power were 350 mW of 1645.1 nm, 160 mW of 1617.2 nm under total incident pump power of 7 W. The slope efficiency were 10%, 5% as shown in Fig. 5.

4. CONCLUSIONS

In summary, we reported a room temperature multi-wavelength Er:YAG laser with double etalons, 1645.1 and 1617.2 nm wavelength were obtained by regulating the angle of the etalons. 350 mW of 1645.1 nm, 160 mW of 1617.2 nm output were achieved under total incident pump power of 7 W. The slope efficiency were 10% at 1645.1 nm, 5% at 1617.2 nm.

REFERENCES