

Investigation on the thermal effects of NaYF₄:Er under the irradiation of 1550 nm

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Supporting Information

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Schematic of temperature measurement setup for infrared thermal imaging camera is shown in Fig.S1. 1). To ensure that the angle between the incident laser beam and the infrared thermal imaging camera is as small as possible without affecting the measurement process. 2). To ensure approximately circle of the laser beam profile in Fig. 4a and symmetry of temperature curve in Fig. 4b. 3). And repeated twice to ensure consistency of temperature measurement result.

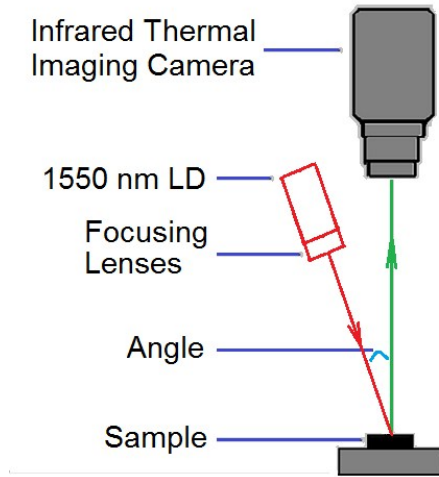


Fig. S1 Schematic of temperature measurement setup for infrared thermal imaging camera

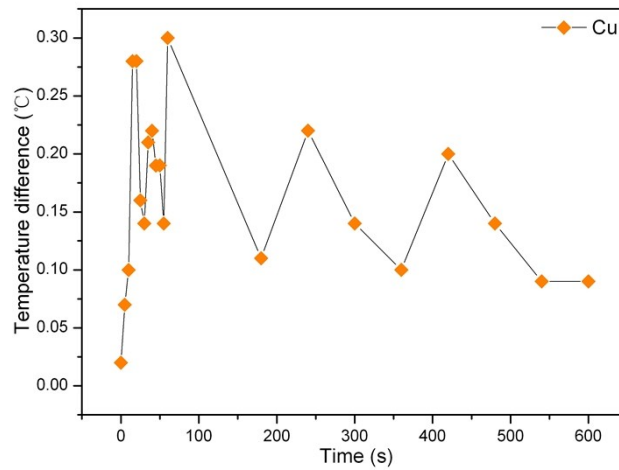


Fig. S2 Dependence of temperature rising elevation of metal Cu on irradiation time under 1550 nm LD irradiation (2.05 W/cm^2).

Fig.S2 shows the temperature rising ΔT of metal Cu disk ($\varphi=14 \text{ mm}$, height=8 mm, $m=16.4 \text{ g}$) on irradiation time of 1550 nm LD under equivalent irradiation condition of Fig. 4 (2.05 W/cm^2 ,

P=127.7 mW). The temperature in the irradiated area of Cu disk presents a rapid rising trend within 15 seconds. ΔT decreased slowly after more than 50 s due to the dissipation of heat and finally stabilized. ΔT in initial stage (t=15 s) is about 0.28 °C in Fig.S2, The heat absorption and heat production of Cu disk was calculated:

$$\text{Heat production: } W = Pt = 127.7 \times 10^{-3} \times 15 \approx 1.9J$$

$$\text{Heat absorption: } \Delta Q = cm\Delta T = 0.39 \times 16.4 \times 0.28 \approx 1.8J;$$

Due to the value of heat absorption and heat production is equality, the temperature rising measurement of metal Cu is accurate.

Table S1 The maximum and mean temperature of spot center.

Time (s)	Temperature (°C)		by VarioCAM camera	by FIR technique
	Max	Mean		
10	28.70	28.48		27.87
60	32.7	30.75		29.47
120	32.71	31.07		30.11
180	32.71	31.19		30.11
240	32.71	31.19		30.42
300	32.79	31.21		30.43
360	32.79	31.22		30.45
420	32.84	31.22		30.48
480	32.68	31.25		30.75
540	32.62	31.39		30.75
600	32.60	31.48		30.73

The average temperature of NaYF₄:25%Er sample under 1550 nm LD pumping was obtained by IRBIS 3 software (0.73 W/cm²). The average temperature data at different irradiation time was shown in [Table S1](#). The calculated temperature by FIR technology based on UCL is an average temperature value of the whole LD irradiation area. But the results showed that temperature values of spots obtained by using FIR temperature measure technology were a little lower than that of average temperature value.