**Review Comments**

**Manuscript ID:**

PJ-006445-2017

**Title:**

Theoretical and experimental investigations of high-power self-mode-locked Pr:YLF visible lasers

**Author:**

Zhiping Cai

Efficient self-mode-lock oscillations of diode-end-pumped Pr:YLF visible lasers at 522 and 639 nm was demonstrated by the authors in this manuscript. The average output powers reached 0.68 and 1.44 W at 522 and 639 nm, respectively, which was the highest among all the visible mode-locking lasers. Compared with passively mode-locked Pr:YLF lasers, with which the average output powers were limited to less than 100 mW owing to the losses introduced by the insertion of Saturable Absorbers such as SESAMs and nano-sheet materials, this scheme could provide higher output powers and opens up new application with those visible sub-nanosecond laser pulses.

The mechanism of self-start mode-locking was speculated to be the intensity modulation induced by Kerr-lens effect and the influence of Stark splitting in gain medium caused by cavity laser field on mode-locking was investigated theoretically, which was firstly reported by Zhijiang Wang et al in 1993. Furthermore, the experimental measured mode-locking spectra was simulated using a numerical model.

In fact, the authors reported very interesting pulsing phenomena for diode-pumped Pr:YLF lasers. However, since Wang’s theory has never been verified by any solid-state lasers before, the authors should be careful to conclude.

I recommend this paper to be accepted by IEEE Photonics Journal after revising the following points and answering the following questions.

1. In the “Introduction” part, the authors state: “In scientific research, high quality lasers sources such as mode-locked lasers or single frequency lasers in the visible spectral region are always desirable since they can be used to explore the energy-level properties of other laser materials or generate efficient down-conversion laser emissions”.

Single frequency lasers are not typically used for efficient down-conversion. Furthermore, the interest in scientific research of mode locked lasers in the visible is much broader than just exploring energy-level properties of other laser materials.

1. The authors state that: “It should be pointed out that the pump power was injected into the laser crystal one by one. That is to say, the left-side pump source was first used with output power increasing from zero to maximum, and then the right-side pump source was started. This could explain the output power characteristics of the red and green laser, as shown in Fig. 2 that there are slow increasing areas starting from about 1.4 W of absorbed pump power, which corresponded to the start-up of the right-side pump source. In fact, the introduction of the right-side pump source increased the pump power absolutely, but also increased the pump volume inside the laser crystal. As a result, it led to the decrease of average pump intensity, and therefore the standstill of the output power.”

This paragraph explains why the slope efficiency decreases at a pump power of 1.4W. However, as shown in Fig. 2(a), thanks to the raise of slope efficiency after introducing the second pump, total slop efficiency did not decrease much even with the standstill of the output power. The authors should explain the reason why the slope efficiency would increase when double-end pumped compared with that when single-end pumped.