

High-efficiency oscillations at 1940 nm and 2070 nm in diode-pumped Tm:Lu₂O₃ ceramics lasers and their OPO frequency conversion

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Abstract — CW and repetitively-pulsed oscillations at 1940 nm or 2070 nm in diode-pumped Tm:Lu₂O₃ ceramics lasers were studied and optimized. Mid-IR optical parametric oscillators based on AgGaSe or ZnGeP nonlinear crystals pumped by the Tm:Lu₂O₃ laser radiation were examined.

Keywords — Laser ceramics, repetitively pulsed oscillations, optical parametric oscillators, mid-infrared band

Solid-state 2- μ m lasers based on Tm- or Ho-doped crystals and glasses having many applications for surgery, material processing, lidars, gas detection, and pumping of mid-IR optical parametric oscillators (OPOs) are attracting great interest in the last years [1]. High-quality laser ceramics are investigated as a substitute for the single crystals. Recently, the sesquioxides Lu₂O₃ ceramics doped by Tm³⁺ ions have demonstrated good potential for the efficient laser oscillations in CW and repetitively pulsed (mode-locking or Q-switched) regimes [2-5].

In this report, we present the recent results of investigations of the diode-pumped Tm:Lu₂O₃ ceramics lasers. The Tm:Lu₂O₃ ceramics under diode pumping at \sim 800 nm were found to be able to oscillate both at around 2070 nm and 1940 nm. CW and Q-switched oscillations regimes in these lasers were studied and optimized. Acousto-optical modulators were used to provide powerful repetitively-pulsed radiation at these wavelengths.

The nonlinear frequency conversion of the 2- μ m radiation of the Tm:Lu₂O₃ lasers was examined. The OPOs based on AgGaSe or ZnGeP nonlinear crystals pumped by the Tm:Lu₂O₃ lasers were created. The mid-IR radiation at wavelengths of 3-5 μ m was obtained.

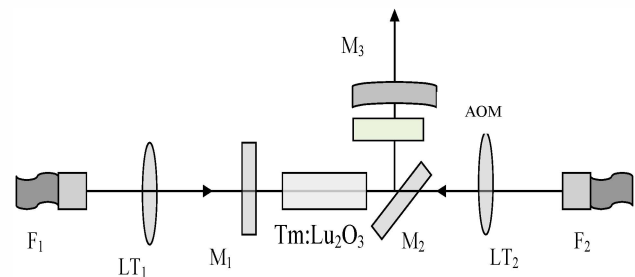


Fig. 1. Experimental schematic of the double-side pumped Tm:Lu₂O₃ ceramics lasers. F₁ and F₂ are the fiber-coupled diodes, LT₁ and LT₂ are telescopes, M₁-M₃ are the cavity mirrors, AOM is the acousto-optical modulator.

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