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50Hz Diode Pumped Er:Glass Eye-Safe Laser Transmitter

Ruikun Wu, J.D.Myers, M.J. Myers

Kigre, Inc.
100 Marshland Road,
Hilton Head Island, SC 29926
Phone# : 803-681-5800
Fax #: 803-681-4559
E-mail : kigre@ aol.com
Kigre@rhsnet.com
Kigre@compuserve.com
WEB PAGE: http://www.kigre.com

Tom Wisnewski

Tracor Flight Systems, Inc., Electronic Systems Division,
557 Mary Esther Cut-Off, Fort Walton Beach, FL 32548
Phone# 850-664-1386 Fax# 850-664-1365
E-mail: twisnewski@tracorservices.com

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ABSTRACT

High repetition rate diode pumped Erbium glass laser was demonstrated at 50Hz with QS output up to 15mj by variouse QS method..

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Diode pumping technology has opened up many new possibilities for Erbium glass lasers for use in eye-safe radar and rangefinding applications. For most radar applications high pulse repetition rates are required. The low thermal conductivity of Erbium glass is a key limiting factor for laser operation at high repetition rates. When compared with traditional flashlamp pumping, the diode pump is more efficient and produces less heat. Diode pumping allows the Er:glass laser to operate at higher repetition rates. In this paper we report on a 50Hz diode laser pumped Erbium glass laser.

We evaluated two different liquid cooled 940nm diode radial pumping heads that were manufactured by the Cutting Edge Optronics. One head is a “Y” configuration that provides 3.3cm of pump gain length. The other head is a pentagon configuration that provides 6.5cm pump gain length. In “Y” shape head three 1 cm diode bars are aligned in a single line to provide 3.3cm of pump length. Three such linear 3 bar units pump a 2.5mm diameter and 33mm long Er:glass rod from side in a “Y” configuration. The “Y” laser head contains a total 9 diode bars. The pentagon pumping head contains 6 bar linear units that each provide 6.5 cm gain length. Five of these linear 6 bar units pump

the rod from the side in pentagon shaped configuration. The pentagon head contains a total of (30) 25 watt diode bars. This provides up to 750 watts of peak power in up to a 5ms pump pulsewidth.

Each 1cm long diode bar is rated at 20W for CW output. Test data shows that each bar output may reach ~25 W at 35A pump current. The 9 bar pump head was pulsed at up to a 5msec pump pulsewidth and 35 A current at 50 Hz. In other tests, the same set-up was operated at up to 70 A and 3msec at 50 Hz. The peak output power of each bar doubled and reached 50 W at shorter pulsewidths and higher currents. Diode bar life testing at the higher pumping levels has yet to be completed.

Erbium glass is low gain laser material that operates under a quasi-three level working principle. It is very important to having no unpumped gain length in the laser head design. Just a few millimeters of unpumped region will introduce absorption losses into the oscillation beam. In order to compensate with this sensitivity, three different rod designs were tested. These were thermal fused, chemical fused (glued), doped and undoped rod regions and metal tube rod collar extensions.

Using the above mentioned pump heads we produced numerous long pulse and Q-switched laser performance curves. Long pulse outputs of up to several hundred milli-Joules and Q-switched outputs of up to 20~30 mJ are demonstrated. Repetition rates from 1 to 50 Hz with different Q-switch methods are reported for both pumping heads.