Advanced Solid-State Lasers

S&T Campaign: Materials Research
Photonics
High Energy & Tactical Laser

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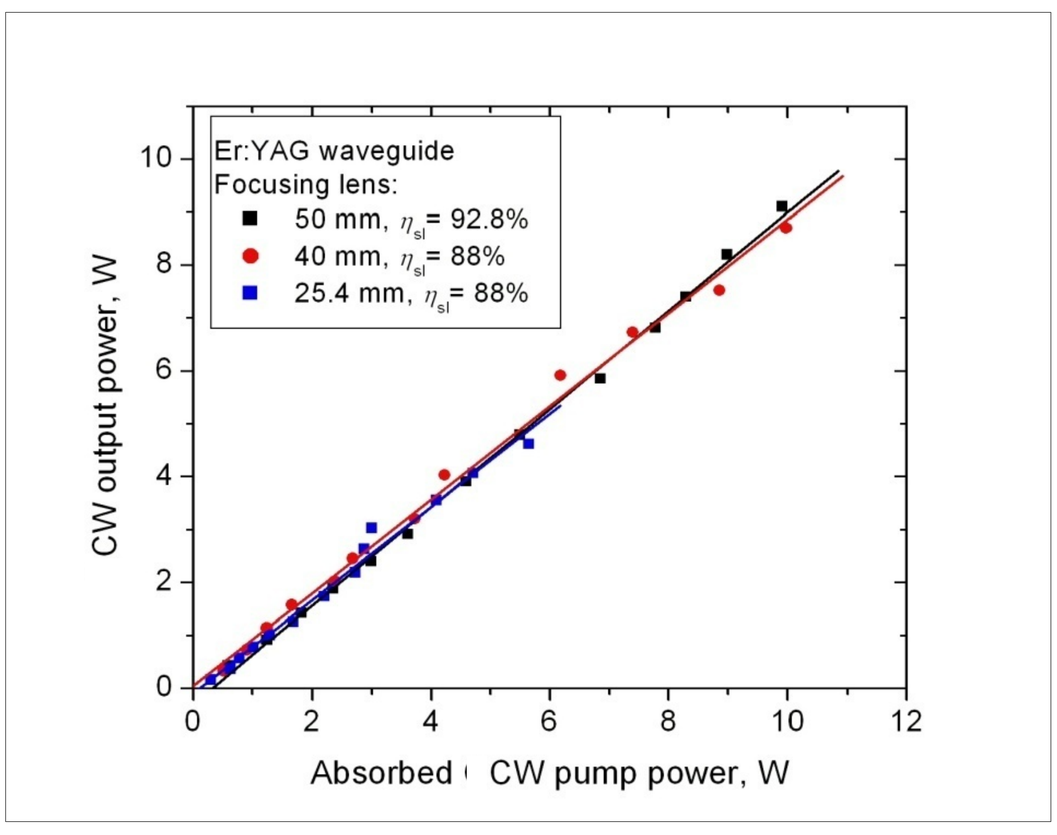
Research Objective

- Develop state-of-the-art solid-state laser technologies to enable and advance Army applications such as target tracking and designation, IR countermeasures, and directed energy weapons.
- We are pushing or breaking records in the efficiency and power of lasers with the beam quality and scalability needed for these applications.

Example: Lasers for tracking and engagement against RAM

Challenges

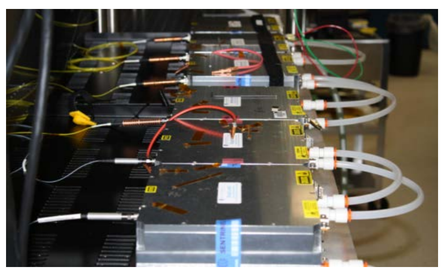
- High laser efficiency, low heat deposition, efficient heat removal
- High intensity in fiber lasers, including pulsed and CW, without damage or deleterious nonlinearities
- Optimal lasers at different wavelengths for different applications

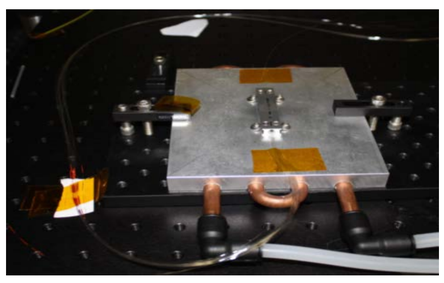


Optical-to-optical efficiency of a single-mode Er:YAG channel waveguide

ARL Facilities and Capabilities Available to Support Collaborative Research

- High power diode lasers for optical pumping – various wavelengths and powers
- Wide range of optical spectroscopy tools and techniques
- Expertise and equipment for diode-pumped laser experiments – bulk solids and fibers
- Unique facility for delivery of high fiber-coupled pump power at a wavelength of about 1.5 μm





Recent achievements as examples of abilities:

- Highest optical-to-optical Er fiber laser efficiency by a power-scalable method (77%)
- Highest power from this type fiber laser (200 W)
- Laser-ion doping of very high thermal conductivity materials, such as sapphire and MgO
- Composite laser materials with SiC (even higher thermal conductivity)
- Highest efficiency from a room temperature waveguide laser

Complementary Expertise / Facilities / Capabilities Sought in Collaboration

- Crystal growth of laser materials of mutual interest
- Design and drawing of optical fibers with high potential for use in powerful lasers – including (but not limited to) large mode area, photonic bandgap fibers, fully crystalline double-clad fibers
- High power fiber laser components (e.g., couplers, isolators)
- Pioneering approaches to beam combining
- Advanced laser diodes for pumping solid-state lasers