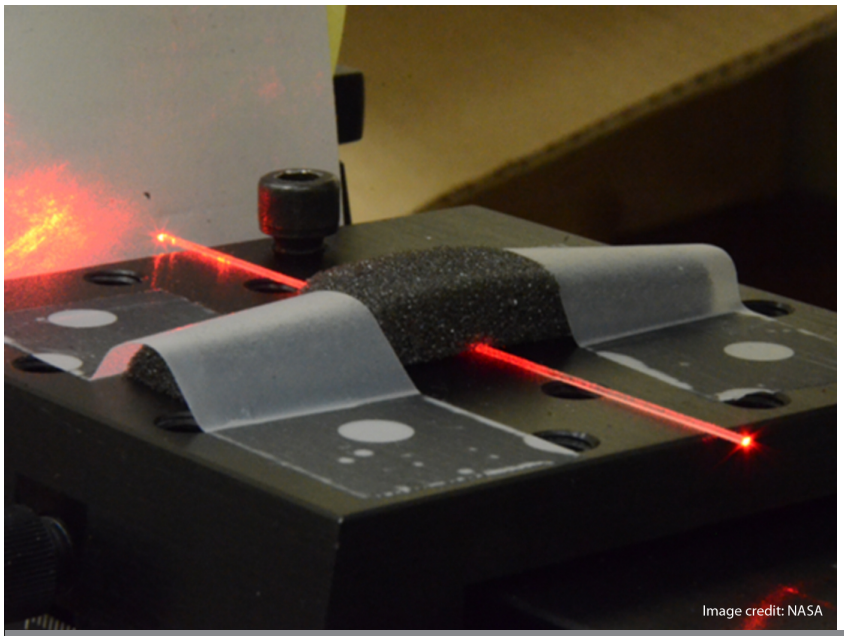


Image credit: NASA

National Aeronautics and Space Administration

TECHNOLOGY SOLUTION

Optics

Free-space Fiber Optic Laser Rod

An innovative approach that removes the limitation on peak power densities that exist for fiber lasers

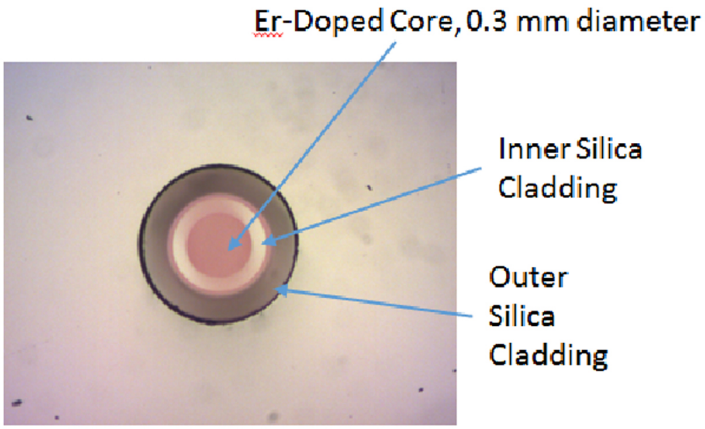
NASA's Langley Research Center has developed a compact and highly efficient multi-purpose laser rod. This system employs a modular laser design with highly efficient and compact components. The laser consists of distinct building blocks to achieve wavelengths of 1.0, 1.5, and 2.0 microns. Amplifier modules are based on a novel hybrid fiber rod concept. By confining the otherwise highly divergent pump radiation to a small channel via total internal reflection at a moderately high numerical aperture interface, the low brightness diodes can pump with high power density over a moderately long absorption path, thereby achieving highly efficient pump absorption.

BENEFITS

- Allows peak powers to be increased by a factor of 10,000
- Achieves optical-to-optical efficiency that approaches theoretical quantum limit

THE TECHNOLOGY

For this new laser concept, a relatively short but large core fiber doped by active lasing material is used in place of a conventional solid state crystal as the amplifier gain media in a free-space configuration. The technology avoids the usual problems of low thresholds for catastrophic optical damage and other nonlinear loss processes in fiber lasers by increasing the fiber core diameter of a standard 9 microns single mode fiber to the order of 1 mm, thereby permitting peak powers to be increased by factors of 10,000. The usual degradation of single mode propagation in large diameter fibers is avoided by keeping fiber lengths short, thereby staying within a free-space single mode propagation regime.



Cross section of hybrid fiber rod. Image credit: NASA

APPLICATIONS

The technology has several potential applications:

- Medical
- Military
- Telecommunications
- Aeronautics and Space

PUBLICATIONS

Patent No: 9,831,629

technology.nasa.gov

NASA's Technology Transfer Program pursues the widest possible applications of agency technology to benefit US citizens. Through partnerships and licensing agreements with industry, the program ensures that NASA's investments in pioneering research find secondary uses that benefit the economy, create jobs, and improve quality of life.

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More Information

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