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14. ABSTRACT

Fiber lasers have demonstrated great potentials for providing high average powers with diffraction-limited beam. Further power scaling of fiber lasers requires significant mitigation of nonlinear effects. Beam combining can then be used to further increase power. Mode area scaling of optical fibers using innovative fiber designs is key to increase nonlinear thresholds. Recently, we have also learned that strong higher-order-mode (HOM) control is critical for mitigation of mode instability, another key to achieve single-mode output at high average powers. In the past few years, we have been studying all-solid photonic bandgap fibers as means for power scaling. This

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Report Title

High-Power All-solid Photonic Bandgap Fiber Lasers

ABSTRACT

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In the past few years, we have been studying all-solid photonic bandgap fibers as means for power scaling. This approach provides an all-solid design, which significantly eases fabrication of robust and compact monolithic fiber laser systems for DoD applications. In addition, this design also provides significant HOM suppression at large-mode areas due to a combination and open and dispersive cladding. Recently, we have demonstrated mode area approaching of 2000μm2 with the best HOM suppression at this mode area among all known designs, to our knowledge.

We have also fabricated ytterbium-doped all-solid photonic bandgap fibers and are in the progress demonstrating and exploring many new capabilities provided by this design. In addition to the potential for large mode areas, all-solid photonic bandgap fibers only transmit lights over a narrow spectrum, i.e. photonic bandgap of the cladding. This can be used to suppress stimulated Raman scattering as well as undesired ASE. We will summarize and update our progress in this area.

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High-power all-solid photonic bandgap fiber lasers

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Abstract:

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Keywords:

Fiber lasers, photonic bandgap fibers, specialty optical fibers

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