Highly flexible fiber delivery of a high peak power nanosecond Nd:YAG laser beam for flexiscopic applications

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Minimally invasive laser surgeries that require the use of a flexible endoscope (flexiscope) could benefit from high-energy nanosecond laser pulses delivered through fibers for real-time tissue characterization and phenotyping. The damage threshold of the fiber's glass material limits the maximum amount of deliverable peak power. To transmit high-energy pulses without damaging the fiber material, large-diameter fibers are typically used, leading to a limited bending radius. Moreover, in a large-core fiber, self-focusing can damage the fiber even if the tip remains intact. In this work, we tested a fused-end fiber bundle combined with a beam shaper capable of delivering more than 20 MW (>100 mJ/5 ns). The fiber bundle was tested over more than eight hours of operation, with different bending radiuses down to 15 mm. The results demonstrate, to the best of our knowledge, the highest peak power delivered through a flexible fiber, for a frequency-doubled Q-switched Nd:YAG laser.
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