Nd:YAG/Cr:YAG セラミックマイクロチップによる 14MW 尖頭値ドーナツモードレーザー

14 MW peak power doughnut mode laser using Nd:YAG ceramic microchip

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Since unstable resonator allows wide and controllable mode aperture in doughnut mode, it is suitable for power scale-up. Doughnut beam has been used in various research fields such as high-efficiency laser trapping, optical guiding of cold atoms and so on. On the other hand, sub-ns microchip lasers have realized and improved the research fields such as laser ignition, an optimum air breakdown, high power THz generation. By combining microchip laser and unstable resonator, we developed a high power and stable doughnut beam laser. We designed the mirror radii of curvatures for the positive branch confocal resonator as 1) fixing the empty cavity length L=10 mm for a short sub-ns pulse width and 2) choosing the magnification, which is the ratio of the mode diameter to output mirror diameter, M = $\sqrt{2}$. However, we first tested and confirmed a stable laser oscillation at 10 Hz repetition rate with a flat back cavity mirror because of simplicity and considering a thermal lens by end pump. Figure 1(a) shows the schematic diagram of experimental setup. A monolithic Nd:YAG/Cr:YAG ceramic (Konoshima Chemical) with a structure of 6×6×7 mm^3 was used for gain medium and passive Q-switch. For output mirror, the center part of the convex surface of a plano-convex lens was HR coated in a 2 mm diameter spot and the other parts are AR coated (OPTOQUEST). Figure 1(b) shows the measured doughnut beam pattern and pulse shape for the laser pulse with an energy of 8 mJ and a width of 570 ps at FWHM. In a conclusion, a stable, compact, and 14 MW peak power doughnut beam laser was demonstrated using a ceramic microchip laser with unstable resonator. This work was supported by ImPACT Program of CSTI.

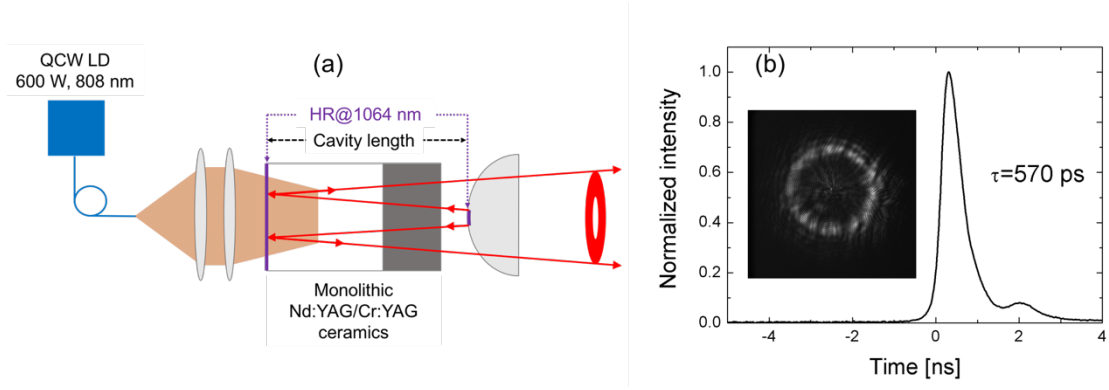

Fig. 1. (a) Schematic diagram of experimental setup. (b) Measured beam pattern and pulse shape.