Two diode lasers with different wavelengths resonantly pumped Er:YAG ceramic single-frequency laser

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Single-frequency solid-state lasers have important applications in laser remote sensing, such as Doppler lidar, differential absorption lidar (DIAL), gravitational wave detection and so on. In recent ten years, highly stable and narrow spectrum single-frequency Q-switched 1.6 μm lasers are widely applied in coherent Doppler wind detection lidar and CH₄ DIAL. For applications in space-based wind lidar and DIAL, high output energy of the lasers is essential. In order to obtain a single-frequency laser with high energy, a common method is to inject a stable single-frequency seed laser into a high-energy Q-switched slave laser. Energy upconversion is the main factor which affects the energy enhancement of Er:YAG laser at 1.6μm. We report a Er:YAG ceramic single-frequency pulsed laser at 1645nm dual-end-pumped by two diode lasers with different wavelengths. Compared to a laser pumped by the two same wavelength diode lasers, the laser has higher slope efficiency because the energy upconversion is weakened. Otherwise, ceramic materials have many advantages compared with single crystals, such as ease of fabrication large-size ceramic material, short fabrication time, low cost and good thermo-mechanical properties. Uniform dopant can be realized in ceramic materials, which are much tougher and stronger than single crystals. All the advantages of ceramic materials mentioned above contribute to scalability to high energy laser. In this letter, we report a single frequency pulse ceramic laser with output energy of more than 10 mJ and pulse-width of more than 150 ns at a repetition rate of 500 Hz, which is pumped by two diode lasers with the wavelengths of 1470 nm and 1532 nm, respectively. This single-frequency pulse laser is a potential candidate as a seed laser for a slab laser amplifier system, which is an ideal source for space-based DIAL and Doppler wind lidar.