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Research of the pico-second CO₂ laser amplifier based on sequence band gain spectrum

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When the ultra-short laser pulse is used for the plasma acceleration, the energy transferring to the charged particle is proportional to the product of the field intensity and the square of the wavelength. Due to its mid-infrared wave band (10.6 μm), CO₂ laser is likely to be one of the most important next generation light source for the laser acceleration of proton and ion. However, due to the discretization and narrow bandwidth of the gain spectrum of CO₂ molecules, it is hard for the chirped pulse amplification being used for the CO₂ laser. This project proposes to increase the gain of CO₂ molecules sequence band using optical pumping and compact the gain spectrum by means of overlapping gain spectrum of sequence band and normal band to solve the problem, realizing pico-second CO₂ pulse amplification at quasi-continuous spectrum. The team will carry out the researches about the absorption spectrum of sequence band, the energy relaxation at each rotational level of the optical pumped sequence band, the coherent amplification process of different spectrum of the input pulse in the different gain band series both theoretically and experimentally. Establishing a synthesis analytical model of a quasi-continuous spectrum CO₂ laser amplification matching electro-optic pump, roundly analyzing influence of gain of CO₂ sequence band on performance characteristics of the amplifier, building pulse discharge CO₂ laser amplifier with innovative structure and high efficiency pumped by solid-state laser, obtaining laser output at ps-mJ level, Laying the theoretically and experimentally foundation for picosecond-Terawatts CO₂ laser system.

Biography

Tang Xiahui is a professor and doctoral supervisor of School of Optical and Electronic Information at Huazhong University of Science and Technology. He is presently the vice-director of the National Engineering Research Center for Laser Processing and he is the executive member of the council of Hubei mechanical engineering society and laser processing committee of the Chinese Optical Society, the vice-chairman of Laser Institute of Hubei Province, the editor of "Laser Technology" and "Applied Laser". His interested areas are high power CO₂ gas Laser, high power laser processing systems integration, welding, brazing, cutting and surface engineering. He published more than 60 papers in the domestic and foreign academic journals, more than 20 papers were SCI, EI, ISTP included and Obtained 5 Chinese invention patents. He received Hubei Science and Technology Progress Award in 2004 and Ministry of Education, National Science and Technology Progress Award nominations in 2005. He has finished the MOST National "Fifteen" Scientific Technological Research Plan, "Eleventh Five" major scientific and technological support plan, Doctoral Fund of Ministry of Education, Hubei Province "Eleventh Five-Year" key scientific and technological and NSFC, respectively. Further, he undertook nearly 60 enterprises of science and technology projects.

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