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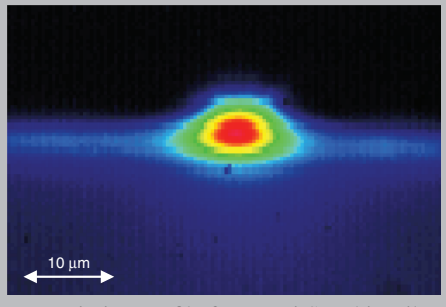
Abstract: Titanium-doped sapphire is one of the most prominent laser materials and is appreciated for its excellent heat conductivity and broadband gain spectrum, allowing for a wide wavelength tunability and generation of ultrashort pulses. As one of the hardest materials, it can also serve as a model system for the fabrication of optical waveguide structures in dielectric crystalline materials and applications in integrated optics. In this paper, we review the recent approaches towards gain and laser operation in Ti:sapphire optical waveguides, including epitaxial growth, surface micro-structuring, and in-depth refractive-index modifications. Several methods including pulsed laser deposition, reactive ion etching, ion in-diffusion, light-ion implantation, and femtosecond-laser irradiation are presented and the results with respect to obtained refractive-index profiles, waveguide propagation losses, and laser performance are discussed.



Fluorescence emission profile from a Ti:Sapphire rib waveguide with depth of 5 μm and a width of 10 μm

Ti:Sapphire waveguide lasers◇

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