

Femtosecond writing of active optical waveguides with astigmatically shaped beams

Roberto Osellame, Stefano Taccheo, Marco Marangoni, Roberta Ramponi, Paolo Laporta, Dario Polli, Sandro De Silvestri, Giulio Cerullo

ABSTRACT

We describe a novel approach for the fabrication of optical waveguides by focused low-repetition-rate femtosecond laser pulses. This approach overcomes the main limitation of the technique, i.e., the strong asymmetry of the waveguide profile. By use of an astigmatic beam and suitably controlling both beam waist and focal position in tangential and sagittal planes, it is possible to shape the focal volume in such a way as to obtain waveguides with a circular transverse profile and of the desired size. This technique is applied to the fabrication of active waveguides in Er:Yb-doped glass substrates. The waveguides are single mode at 1.5 μm and exhibit propagation losses of 0.25 dB/cm and an internal gain of 1.4 dB at 1534 nm.

Keywords (OCIS):

(130.3120) Integrated optics : Integrated optics devices

(220.4000) Optical design and fabrication : Microstructure fabrication

(320.7110) Ultrafast optics : Ultrafast nonlinear optics