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Optical Waveguides Written in Silicon with Femtosecond Laser¹ IHOR PAVLOV, ONUR TOKEL, Bilkent University, SVITLANA PAVLOVA, VIK-TOR KADAN, Institute of Physics National Academy of Sciences of Ukraine, GHAITH MAKEY, AHMED TURNALI, OMER ILDAY, Bilkent University — Silicon is one of the most widely used materials in modern technology, ranging from electronics and Si-photonics to microfluidic and sensor applications. Despite the long history of Si-based devices, and the strong demand for opto-electronical integration, 3D Si laser processing technology is still challenging. Recently, nanosecond-pulsed laser was used to fabricate embedded holographic elements in Si [1]. However, until now, there was no demonstration of femtosecond-laser-written optical elements inside Si. In this paper, we present optical waveguides written deep inside Si with 1.5 um femtosecond laser. The laser beam, with 2 uJ pulse energy and 350 fs pulse duration focused inside Si sample, produces permanent modification of Si. By moving the lens along the beam direction we were able to produce optical waveguides up to 5 mm long. The diameter of the waveguide is measured to be 10 um. The waveguides were characterized with both optical shadowgraphy and far field imaging after CW light coupling. We observed nearly single mode propagation of light inside of the waveguide. The obtained difference of refractive index inside of the waveguide, is 2.5*10-4. [1]Tokel.et.al.,arxiv.org/abs/1409.2827

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