Characterization of low-loss optical waveguides in carbon ion irradiated $KY(WO_4)_2$

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The family of potassium double tungstate materials ($KY(WO_4)_2$, $KYb(WO_4)_2$, $KGd(WO_4)_2$, etc.) has been extensively used in the past as both host materials for rare-earth ions and Raman laser crystals, due to their high Raman gain [1], excellent characteristics when doped with rare-earth ions [2] and their high refractive index (n≈2-2.08 @ 1550 nm) [3]. In the past years, a great deal of research efforts have been directed towards the fabrication of thin rare-earth ion doped layers of these materials for the development of integrated devices exploiting their good gain and Raman properties [4-5]. In our work, we use 9 MeV swift carbon ion irradiation to produce a low refractive index amorphized layer (n~1.85) buried ~1.5 µm below the surface. The effect of annealing on the recovery of the optical properties of the crystal has been studied, showing crystalline changes due to annealing at 350°C. Optical waveguides have also been demonstrated with optical slab losses of 1-1.5 dB/cm at 1550 nm. In this paper, we will describe in detail the fabrication process of these waveguides, including the development of a RIE recipe to produce low loss channel waveguides.

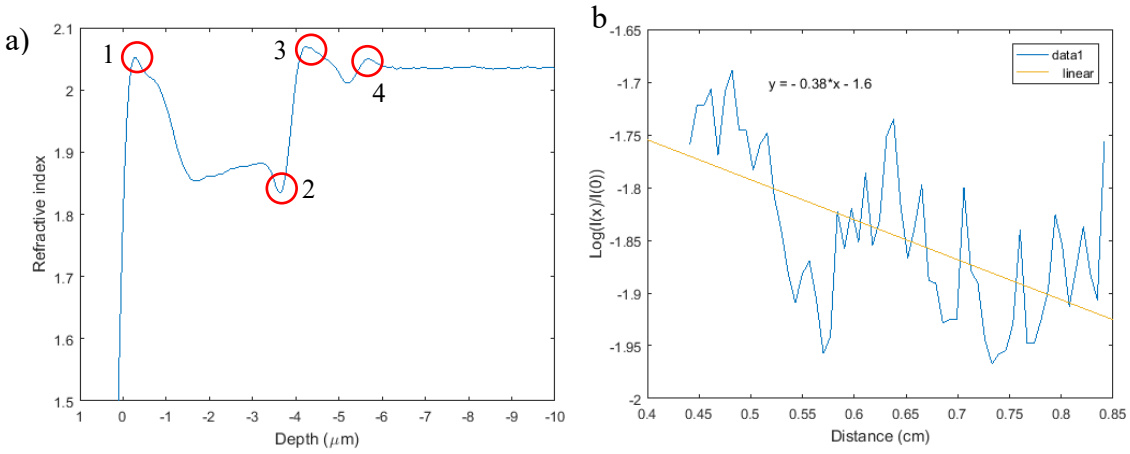

Figure 1. a) Refractive index profile of the planar waveguides for 633 nm TE polarized light, caused by carbon irradiation and subsequent annealing of a $KY(WO_4)_2$ crystal, and b) the scattered intensity of 1550 nm, TE-polarized light propagating through the planar waveguide showing an optical loss of <1.5 dB/cm.

References

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