2.3 Photorefractive Characterisation of Doped $KNbO_3$ Crystals for Application in the Red and Near Infrared

(C. Medrano and I. Liakatas)

$KNbO_3$ can be considered one of the most photosensitive photorefractive materials whose potential for several applications, such as dynamic holography, optical phase conjugation, and real-time optical signal processing, has been already outlined. By means of electrochemical reduction treatment, the photorefractive speed of response has been optimized. Steady improvement in semiconductor lasers operating in the near infrared spectral region has stimulated research for an efficient photorefractive material working at these wavelengths.

Investigation of optical, electrical, and photorefractive properties of these crystals in the visible and near infrared spectral range allows a complete characterization of the new materials. Pure crystals present no absorption bands in the visible and infrared region of the spectrum. With iron doping, small changes in the absorption spectrum are produced. After doping with Ni, new absorption bands were observed centered around 450, 630 and 870 nm. For the case of Cu ions, broad absorption bands were observed at 680 nm. Photoconductivity was not changed in the new doped samples at 488 and 515 nm, however at 600, 830 and 1064 nm, a remarkable increase in the photoconductivity values was measured in the nickel and copper doped samples as compared to iron doped $KNbO_3$. As for the photorefractive properties, copper and nickel ions in the lattice of potassium niobate do not increase the value of the two-beam coupling gain at visible wavelengths in a more efficient way than iron does. However exponential gains of 3.6 cm^{-1} at 600 nm and 1.4 cm^{-1} at 860 nm determined from beam coupling experiments were measured in the nickel doped potassium niobate crystals. In copper doped crystals, maximum beam coupling gains of 8 and 3.2 cm^{-1} were measured at 633 and 860 nm, respectively. On the other hand, nickel and copper ions do not seem to improve the response time of potassium niobate as compared to iron-doped $KNbO_3$. Further investigation of $KNbO_3$ crystals with other dopants is presently being performed.