Two-wave Mixing in Photorefractive SBN Planar Waveguides.

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Planar waveguides have been fabricated in SBN:61 and SBN:75 by ion-beam implantation.The implantion was carried out using 2.0MeV H^+ ions with doses ranging from 2×10^{15} ions cm^{-2} to 1×10^{16} ions cm^{-2} . The minimum propagation loss observed for the TM mode was 1.1dB cm^{-1} and 12dB cm^{-1} for the TE mode. These losses are significantly lower than those observed for planar waveguides fabricated previously using sulphur diffusion[1].

Two beam coupling experiments were then carried out on the SBN waveguide where it was observed that the gain direction was the same as that of the bulk crystal. Previously, in both $BaTiO_3$[2] and $KNbO_3$[3] planar waveguides fabricated in the same manner, the gain direction for two beam coupling had been shown to reverse. This phenomenon may be due to the ion beam implantation process reducing the waveguide layer and subsequently changing the ratio of impurity atom oxidation states - in the case of $BaTiO_3$, the ratio of Fe^{2+}:Fe^{3+} . It is thought that the preodominant photoexcited charge carrier in both $BaTiO_3$ and $KNbO_3$ is changed from the hole to the electron whereas in SBN , the electron remains the predominant carrier even after the implantation process. Modelling of these effects has been undertaken, giving an explanation of why gain reversal should occur in certain photorefractive planar waveguides fabricated by ion-beam implantation.

This paper will discuss the gain and response time of the SBN waveguide in comparison to the bulk and the theoretical predictions of the effects of ion-beam implantation on photorefractive materials.

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