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EFFECTS OF MULTI-ENERGY Si AND O ION IMPLANTATION ON THE OPTICAL PROPERTIES OF SILICA

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Intrinsic defects in silica are of renewed interest because of the discovery of photonic induced Bragg gratings in glass. The models used to explain the process of forming Bragg gratings in optical fibers and waveguides suggest that it is the photosensitivity of defect structures to UV irradiation in either a densification process or a bleaching process that results in the changes in the index of refraction, Δn. The objective of this research was to identify the optical bands arising from intrinsic defects in silica by changing the stoichiometry of an implanted layer in silica by implanting O or Si.

Some effects on the optical bands produced by multi-energy (highest energy 320 keV) Si and O implantations in (Type III) silica have been measured. Si ions were implanted using implant energies ranging from 35 keV to 320 keV. O ions were implanted using energies ranging from 35 keV to 250 keV. The doses at each energy were varied to maintain an approximately constant implant species concentration. In Si and O implanted samples, TRIM calculations and Profile 318 calculations indicate the implanted layer has an approximately constant concentration for the Si ions that starts at the surface and extends for 600 nm. The Si concentration in the implanted region ranges from ~ 0.03 to 0.6 atomic percent, while the concentration for the O in the implanted region ranges from 0.035 to 0.7 atomic percent.

The optical absorption was measured from 2.8 eV to 6.5 eV. We fit the observed spectra for the as implanted samples to the minimum number of bands attributed to intrinsic states in SiO_2 required to fit the data within $\pm$ 2 %. The intensities of these absorption bands were functions of dose and ion species.

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