Photorefractivity of indium oxide (InO_x) using 193nm excimer laser radiation

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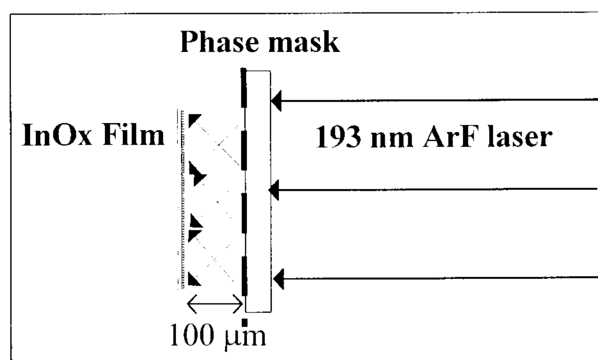
Indium Oxide (InO_x) is being extensively used in microelectronic technology due to its important optical and electrical properties. Dymanic photorefractive behaviour of InO_x exposed in the near UV region (325nm) at low intensity (~0.25W/cm^2) has been demonstrated for films grown by DC magnetron sputtering [1] and Pulsed Laser Deposition [2].
In this paper the investigation of photorefractive effects of InO_x in the deep UV region (193 nm) is presented. Polycrystalline InO_x films were grown by DC magnetron sputtering, in O_2/Ar atmosphere, in a variety of thicknesses (0.5 μm- 4 μm).
Photorefractive gratings were recorded in InO_x films using a typical "in contact" phase mask configuration. An ArF excimer laser delivering 20 nsec pulses (FWHM) @ 193 nm was used for the phase mask illumination at an intensity of 0.9MW/cm^2 (energy density of 1.8×10^{-2} J/cm^2). Single and multi-pulse exposures were performed at low repetition rates. The recorded gratings were detected using a He-Ne laser at normal incidence and the refractive index changes produced were calculated from the measured diffraction efficiency. Refractive index changes up to 5.0×10^{-3} were observed. The stability of the photoinduced index changes were investigated by monitoring the diffraction efficiency dynamics. The monitored diffraction efficiency decays reaching a platau approximately 50% of its initial peak.
The photorefractivity of InO_x using high power c.w. 244nm and pulsed 248nm laser radiation has also been investigated. Possible applications of InO_x films include high refractive index waveguide overlays for sensor and telecommunication purposes.

Phase mask arrangement for grating recording



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Abstract

Photorefractive gratings structures have been formed in Indium Oxide films using a 193nm excimer laser illuminating a phase mask. Refractive index changes up to 5 $x10^{-3}$ were measured and the dynamic behaviour of the effect studied.