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Non-steady-state photocurrents and holographic recording in indium-oxide (In_2O_3) thin films

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Summary

Indium-oxide thin films present interesting electrical and optical properties and high potential for technological applications. The conductivity of indium-oxide thin films grown by dc-magnetron or laser sputtering can be modified upon illumination with ultraviolet radiation (photon energy > 3.5 eV), resulting in a variable electrical state of the films from a resistive to a purely conductive one, while recently holographic recording has been demonstrated [1] aiming to information storage and processing applications.

We report simultaneous measurement of the non-steady-state photoelectromotive force [2] and holographic recording in indium-oxide thin films at the He-Cd laser wavelength of 325 nm (Fig. 1). Two He-Cd laser beams formed a holographic grating in the thin film. One of the beams was phase modulated at frequency ω and a HeNe laser beam was monitoring the holographic recording. Two scattered beams of equal intensity were observed, corresponding to the ±1 diffraction orders of the recorded sinusoidal grating, and monitored. The non-steady-state photocurrent J^{ω} was detected by applying lock-in techniques. The decay time constants of the diffraction efficiency and non-steady-state photocurrent were found to be in the range of 5-50 s, naturally depending on fringe spacing. Diffraction efficiency of the recorded grating was 2.5×10^{-5}. The combination of the above methods provides a powerful tool for the investigation of holographic properties in this material.

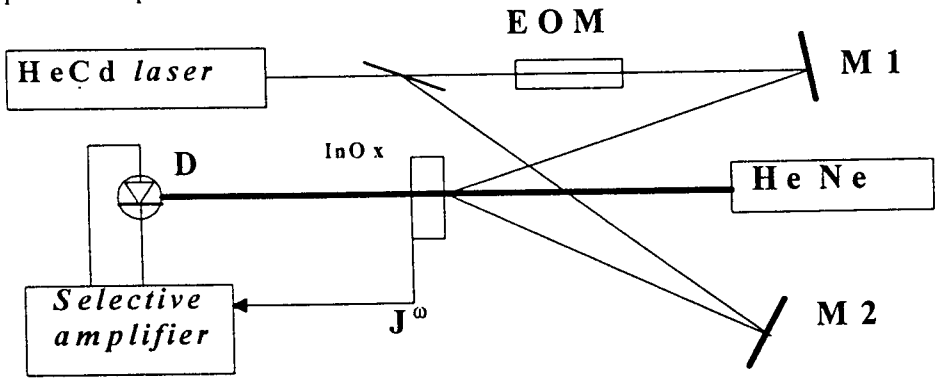

Fig.1 Schematic of the experimental setup used for holographic recording and non-steady-state photocurrent excitation (D- photodiode, M1, M2 -mirrors, EOM - phase modulator).

References

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