Holography Applied to Study of New Photochromic Materials

Karoline F. Tornisiello*, Luís Fernando de Avila.

Abstract

In this work, we use a Lloyd mirror interferometer and phase sensitive technique to measure the phase modulation of a epoxy polymer with TiAu nanoparticles for the first time. The results demonstrates the photosensitivity of these materials for diferents nanoparticles concentrations.

Key words:

Holography, photosensitive materials , Loyd mirror.

Introduction

Holography is known due to their ability to record images of three-dimensional objects as well as for the fabrication of optical memories with high capacity information storage. Through interference between two laser beams it is also possible to record holographic optical components, performing phase conjugation experiments with high precision measurement wavefront distortion, etc. An interference or holographic pattern can also be projected on a photosensitive material to produce periodic spatial variations in its optical constants for studying the properties of these photosensitive materials by using diffraction techniques.

For the study of new photosensitive materials, we use a Lloyd mirror interferometer (Figure 1). Lloyd's Mirror is an experiment that gets an interference pattern using a coherent light source (laser), and a mirror.

The materials analyzed based epoxy polymer containing TiAu nanoparticles were developed at the University of the Basque Country, San Sebastian, Spain in collaboration with Teacher Agnieszka Tercjak. This project aims to characterize holographically new photosensitive materials as to their optical properties.

Figure 1. Experimental setup used in the experiment.

Results and Discussion

The experiment consist in the measurement of the refractive index modulations during exposure. It was used synchronous detection system for stabilizing the interference fringes. The first harmonic measured is proportional to the phase modulation formed in the material. From these measurements we obtain the quantitative data of the modulations of the optical constants. The Figure 2 shows that the amplitude of the

first harmonic increase with the concentration of the samples. It is clear that the synthetized materials have photosensitive characteristics.

Figure 2. Signal measure the first harmonic for different concentrations.

Conclusions

It was possible to obtain results that indicate the effect of photosensitivity of the samples synthetized using a holographic interference pattern. It is still necessary to investigate the phenomenon varying the wavelength and power of the incident light, in order to obtain more information about their sensitivity as function of the spectrum.

It is important note that these materials have never been studied from the point of view of holographic optical characterization.

Acknowledgement

We acknowledgement the CNPq and PRP for financial support of this work.

¹ L. F. Avila, A. A. Freschi, and Lucila Cescato, "Holographic technique for measurement of the kinetic constant and optical modulation of photosensitive materials," Appl. Opt. 49, 3499-3505 (2010).