PROCEEDINGS

INTERNATIONAL COMMISSION FOR OPTICS

Reprinted from

15th Congress of the
International Commission for Optics

Optics in Complex Systems

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Editors

August 5–10, 1990
Garmisch-Partenkirchen
FRG

SPIE Volume 1319

Published in cooperation with
ICO—International Commission for Optics
SPIE—The International Society for Optical Engineering

EXPERIMENTAL RESULTS IN THICKNESS AND INDEX VARIATIONS TO THE ANALYSIS OF HOLOGRAPHIC ABERRATIONS

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1. INTRODUCTION

Variations in the average refractive index and thickness of the holographic recording material are present due to chemical processing. These changes produce a reordering of the internal structure of the interference fringes so we can see that the processed material and the registered material are different. In this paper we have analyzed the influences of exposure and geometric disposition of the recording beams on the variations of the maximum diffraction efficiency.

Our previous research[1] has shown that the parameter used to analyze the influences of the thickness and index variations is defined as:

$$\frac{T}{N} = \frac{\sin\alpha_R + \sin\alpha_0}{2\sin\alpha_C + \sin\alpha_0 - \sin\alpha_R}$$

where $T = t_C/t_R$ and $N = n_C/n_R$ (t and n represent the thickness and the refractive index of the medium, respectively); α_R, α_0 and α_C are the angles in relation to the normal for holograms.

2. EXPERIMENTS

We have made diffraction gratings with different recording angles and with different exposures. In figure 1 we have represented the variations of maximum diffraction efficiency as a function of energy, and in figure 2 we have represented the variations of T/N in maximum diffraction efficiency as a function of energy. In figure 3 we have represented the same as a function of the recording angle. All the experiments were carried out with two different bleaching processes: rehalogenating (A) and solvent(B).

3. CONCLUSIONS

As we can see there are very important variations of T/N due to the parameter analyzed in this paper. According to a previous paper[1], these variations can cause wave-aberrations of approximately 1000 λ if a maximum diffraction efficiency is achieved in the reconstruction process.

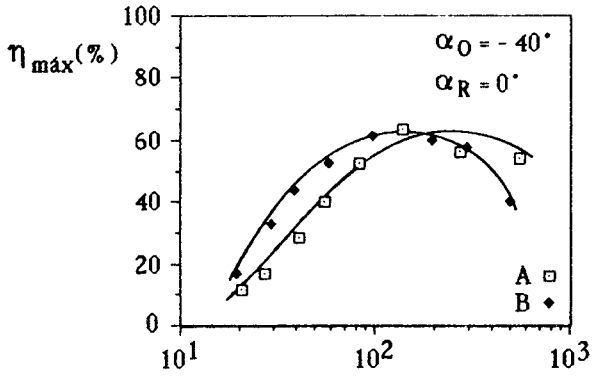

Figure 1

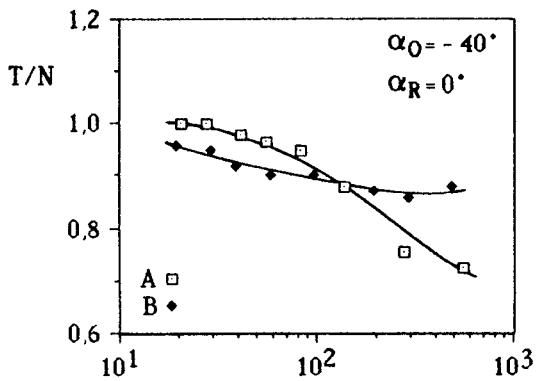

Figure 2

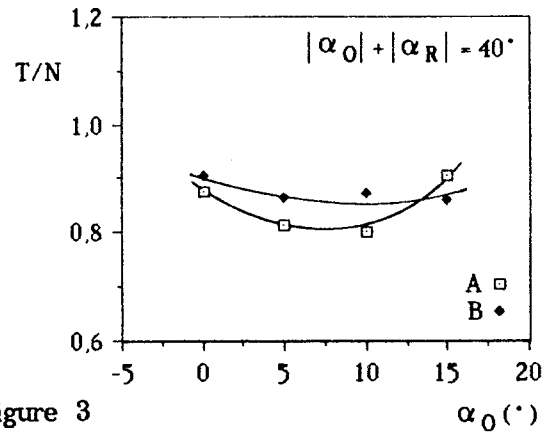

Figure 3

4. REFERENCES

1.-A. Beléndez, I. Pascual and A. Fimia, "Influences of recording materials in HOE". Proceeding SPIE, vol. 1136, pp. 58-65. 1989.