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HOLOGRAPHIC INTERCONNECTORS IN SILVER HALIDE SENSITIZED GELATIN

R. Fuentes, I. Pascual, A. Beléndez and A. Fimia

Laboratorio de Optica, Departamento Interuniversitario de Optica, Universidad de Alicante. Apdo. 99, Alicante 03080 Spain.

J. J. Egozcue and M.T. Navarro

Departamento de Matematicas Aplicadas III, Universidad Politecnica de Cataluña. Barcelona 08034, Spain.

ABSTRACT

When making interconnection holographic systems, it is important to obtain high diffraction efficiency and low noise levels. Silver halide sensitized gelatins have been shown to be an excellent material to use in transmission holographic systems because these two objectives can be met, Using a copying process that has been throughly tested in our laboratory, we obtained a 64-beam interconnector with a diffraction efficiency of 12.3 and a signal to noise ratio of 8.5 in each beam. The deviation between the diffraction efficiency of each diffracted beam is 58%. A improvement over the values corresponding to the original that was used in the copiying process is achieved.

INTRODUCTION

Some progress in the desing and optimization of holographic interconnectors has been made thanks to the use of computers in the desing process. By using computer generated holograms it is possible to desing interconnection systems in which the profiles of the interferential figures can be controlled, thereby optimizing the SNR and the diffraction efficiency. However, very little work has been done on the production in series of these systems. In this paper we show that it is possible to make a large number of interconnectors by using the copying method that has been carefully developed in our laboratory[1].

RECORDING MATERIAL

A computer was used to desing the original which, by means of photoreduction, was then stored in a 8E56 HD photographic emulsion using a common developing and fixation process.
The copy was made using partially coherent light from a high pressure mercury lamp and a 8E75 HD emulsion was used in the second stage. The processing used for the copy was the one corresponding to silver halide sensitized gelatins (SHSG)[2]. This

processing allows for high diffraction efficiency and low noise. The diffraction efficiency was measured in each of the 64 diffracted beams and the SNR was calculated measuring light that was diffused among the different diffracted beams according to the following equation:

$$SNR = \sum_{i=1}^{n} \sum_{j=1}^{n} \frac{DE_i}{DE_{ij}}$$

where (DE)i is the light diffracted by the i-beam and (DE)ij is the light diffracted between the i and j beam.We also evaluated the difference between the diffraction efficiency corresponding to the different interconnectors beams using the expression that follows:

$$D(DE) = (DE(max) - DE (min))/ (DE(max)+DE(min))$$

TABLE I

PROCESS	$DE_{(max)}$(%)	$DE_{(min)}$(%)	SNR	D(DE)%	Q factor
Photograp. Emulsions	1.63	0.47	22.3	55	66.2
SHSG	12.3	3.3	8.5	58	180.3

Table I shows a summary of our results. We compared the data we obtained with the original to those corresponding to the copy. As can be seen, the values corresponding to the copy are much better than those pertaining to the original. One important aspect is that if we calculated the value of the maximun diffraction efficiency, multiply it by the SNR and divide it by the dispersion that exists between the maximun and minimun values for the diffraction efficiency, we find a coeficient (Q factor) that tells us the overall optimal characteristic of the interconnector. In other words, we see that all of the beams are highly diffracted, that there is not much difference in their values, and that at the same time high SNRs are achieved. As can be seen in the Table I, the copy has a much better quality coefficient than the original.

CONCLUSIONS

We have shown that it is possible to obtain holographic interconnectors by copying masters obtained through photoreduction and designed by computer. Silver halide sensitized gelatins have been shown to be an ideal material for making the copies, and their use allows for great improvement in the copy when compared to the original.

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