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Holographic photopolymers: a sustainable design

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Summary

In this work we have developed new photopolymers with a sustainable design. These materials have a holographic performance similar to standard hydrophilic photopolymers acrylamide based but with an improved environmental compatibility.

Introduction

Photopolymers are useful materials for different applications: holographic memories, holographic optical elements, holographic recording media. These applications could to have an important role in the near future [1].

Hydrophilic photopolymers with acrylamide (AA) as polymerizable monomer are versatile materials as holographic recording media. Recently, they have proved their good qualities in applications directed toward the development of devices with industrial use as holographic recording materials or as holographic memories. For the last application our research team have developed a photopolymer in layers with 1 mm thickness and their main holographic characteristics have been evaluated [2,3].

The use of water as solvent and plasticizer introduces an important advantage related to the principles of the sustainable chemistry, but the main problem for this photopolymer is AA, a known carcinogenic substance since many years.

We have developed new photopolymers with photochemical and holographic features similar to the standard materials but with an improved design for the environmental aspects. We have requested a patent for this material [4].

Discussion

Figure 1 shows the angular scan for the holograms stored in the photopolymers after recording. First, we can see the difference in the angular width of the curves for the standard A photopolymer and new B, C photopolymers with sustainable design. For A photopolymer the DEmax has an angular interval higher than 0.4°. On the other hand, B, C photopolymers have an angular interval lower than 0.2°. This point to a deeper polymer grating according to Kogelnik theory.

This result is derived of the minor absorption of the new photopolymers respect to A photopolymer for the recording wavelength. A small angular interval is very interesting in recording of many holograms by multiplexing, due to that it is more difficult the overlapping of the holograms and this let an easy reconstruction of these holograms. Moreover, the photopolymer thickness is used with more efficiency

because the polymer grating is deeper, proportionally to the decreasing of the angular interval of the angular response curve.

Another important result is derived from the high DEmax values obtained 55-56%. The new photopolymers not introduce limitations in the performance offered by the standard photopolymer.

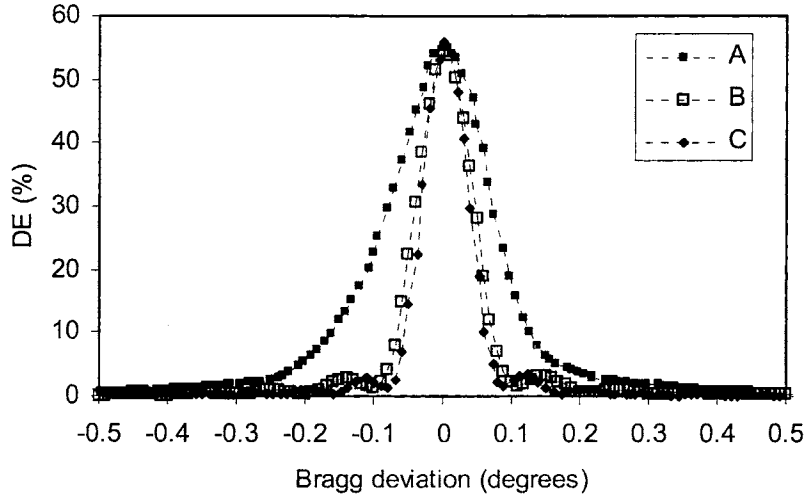

Fig. 1: Angular scan for the holograms stored. A is the standard photopolymer. B, C are the photopolymers developed

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