Azopolysiloxanes as supports for biomolecules laser nano-manipulation

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Photo-induced isomerizations of the azo-groups connected to a polymeric chain, can provide cooperative forces able to affect self-assembling processes in the fluid state or leading to an efficient mass transport in the solid state. Processed as solutions, films or bulk, these light responsive materials can generate original functionalities with interesting prospects for a wide range of applications. For example, using a laser polarized light source, directional flow on the azopolymeric film surface can be induced. This unique behavior, characteristic only to the azo-polymers, presents a potential interest in the laser nano-object manipulation techniques.

We discuss here the possibility to obtain azo-polymers having a polysiloxanic structure as main-chain, and the capacity of these materials to generate a light induced fluid phase (able to flow parallel with the laser irradiation direction) [1-2]. The result of the directional flow process can be the possibility to obtain surface relief gratings (SRG), having amplitudes between 50 and 400 nm, and 1-3 micrometers periodicity (in the case of our polymers). This SRG formation phenomenon has been a subject of many debates, recent experimental and theoretical studies showing contradictory results which question the validity of the concept. We therefore propose a new approach of the SRG formation, based on three different processes: (1) the polymer photo-softening/-fluidization in illuminated regions, (2) the mass displacement from illuminated to dark regions and (3) the inverse mass displacement, from dark to illuminated regions [1].

But the photo-induced directional flow can be applied, too, for laser nano-manipulation of very small objects, as biomolecules or gold nanoparticles. The possibility to immobilize DNA chains at the azopolymeric films surface is reported by us [3], but, probably due to the azobenzen segments intercalation into the DNA chain helices, the DNA is completely embedded into the azo-polysiloxanic. This behavior was not evidenced in the case of gold nanoparticles, having a diameter of 50-60 nm.

The possibility to use azo-polysiloxanes films as support for cell cultures is also discussed [4].

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