

THE SELF-INDUCED ENSEMBLE OF PARTICLES AND ANISOTROPY PHOTOINDUCTION IN ORGANIC COMPOUNDS

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Abstract. The work is dedicated to anisotropy photoinduction phenomenon in organic compounds, in particular, in the gelatin or polyvinyl films, dyed by azodyes. Here, using the video microscopy is revealed that during the film preparation, when drying, the self-induction of micro particles ensemble having polarizing sensitivity takes place. As a result of acting on that film by polarized light the anisotropy photoinduction in form of "grains" is obtained, where, according to active light exposition the anisotropy integral area is modulated.

Keywords: anisotropy photoinduction, molecular aggregates, azodyes

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1. Introduction

The anisotropy photoinduction phenomenon in organic compounds (Kondo, 1932) is a subject of keen interest for a long time in a viewpoint of his use in information processing, nonlinear optics, holography and other spheres of technologies.

According to existing view, the anisotropy photoinduction phenomenon is a result of molecular regrouping obtained by trans-cis-trans photoisomerisation (Makushenko *et al.*, 1971; Labarthe *et al.*, 2000). Thus, considering the film with photoinduced anisotropy in azodyes only as monocrystal, is believed that the optical image formation is implemented by spatial distributing of film birefringence value by light exposure. However, in our point of view, in addition, the image formation in film can be implemented otherwise at same time, in particular, by spatial distributing of "grains", as it is in silver emulsions in photography, but these "grains" here are anisotropic particles.

This opinion on the one hand is based on the fact that anisotropy photoinduction phenomenon was first discovered by Weigert in photographic films (Weigert, 1919), and photographic films, according to preparation technology, have a "grain" structure a priori; and based on similarity of natural phenomena it is expected that the anisotropy induction would occur in the same way as in silver emulsions. On the other hand, during the anisotropy photoinduction process in order to obtain the noticeable effect is necessary dye concentration to be in solution in great value. However, a high concentration of dye in solutions by drying leads us to self induction of dye micro particles "grain" ensemble, and, as a result, to creation of "grain" structure having

polarization sensitivity (Ebralidze *et al.*, 1998; Ebralidze *et al.*, 2009; Ebralidze *et al.*, 2013; Ebralidze *et al.*, 2014; Ebralidze *et al.*, 2015; Ebralidze & Mumladze, 1990).

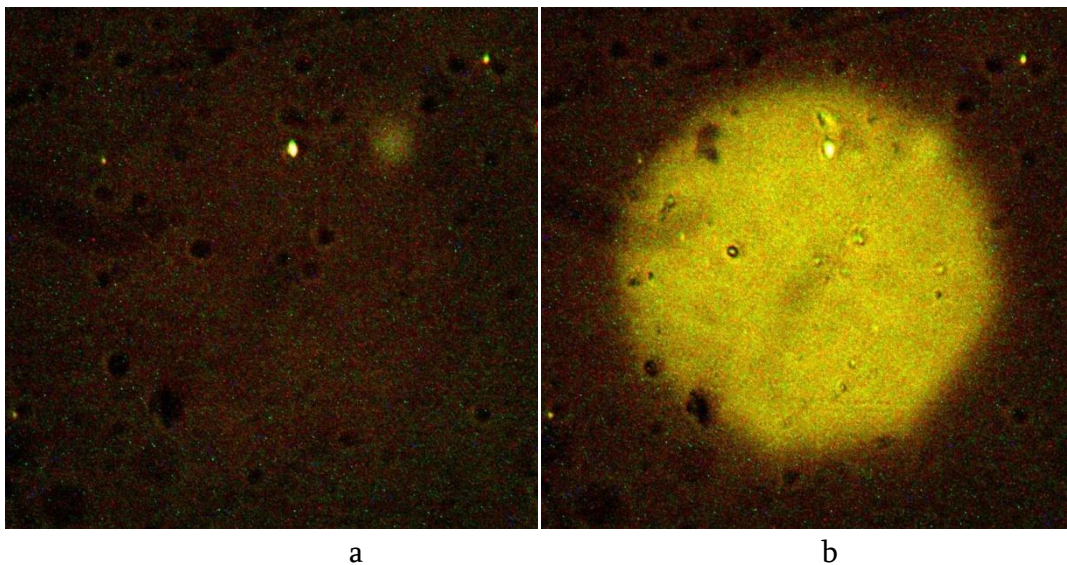
In the work (Ebralidze, 2015) for the polyvinyl film dyed by "Mordant Pure Yellow" azodye, the optical image formation picture during the anisotropy photoinduction process in the self-induced molecular ensemble of aggregates is presented. It is shown that here the optical image is forming in a manner by which, depending on active light exposition, the integral area of photoinduced anisotropy is modulated. As a result, anisotropy finally is formed in the film in the approximately continuous shape.

In the given work there is presented an image of anisotropy induction kinetics in the film selected as a result of provided investigations on the various probes of mentioned material; here, the anisotropic image in the strong continuous shape is formed finally.

2. The experiment

In that experiment we had a film with polarization sensitivity. It was obtained by pouring of polyvinyl solution dyed by azodye "Mordant Pure Yellow" to microscope slide and subsequent drying. This film was placed to a sample stage of polarizing microscope fluorometer. The film is a subject of active linearly polarized light exposure. The observation on the photoinduced anisotropy is implemented in the conditions of white light and crossed polarizers as well. The active light polarization vector made an angle of 45 deg. to crossed polarizers' optical axes. The observation took place in the dynamic regime of anisotropy photoinduction. The implemented optical scheme provided separation of recording beam from reading beam.

The observation and shooting of object took place by 5 mpx resolution microscope ocular camera. Shootings were provided in 2 sec. time intervals distanced from each other. Then we selected several from the obtained series of 60 images. Images very different from each other were selected by micro structure — of beginning, middle and last part of series. Here (Fig.1) we're presenting 4 images selected one by one from these series:



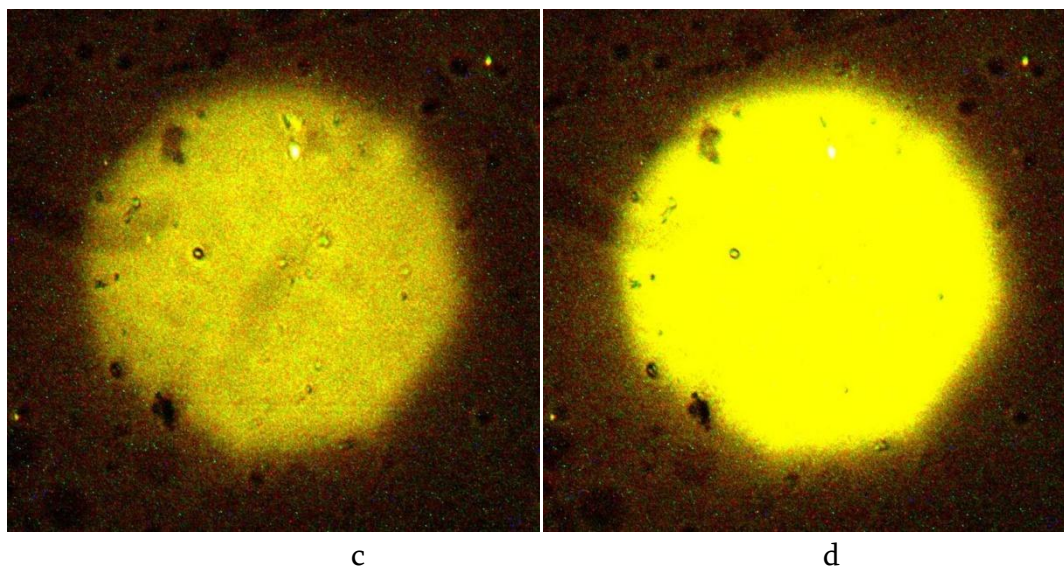
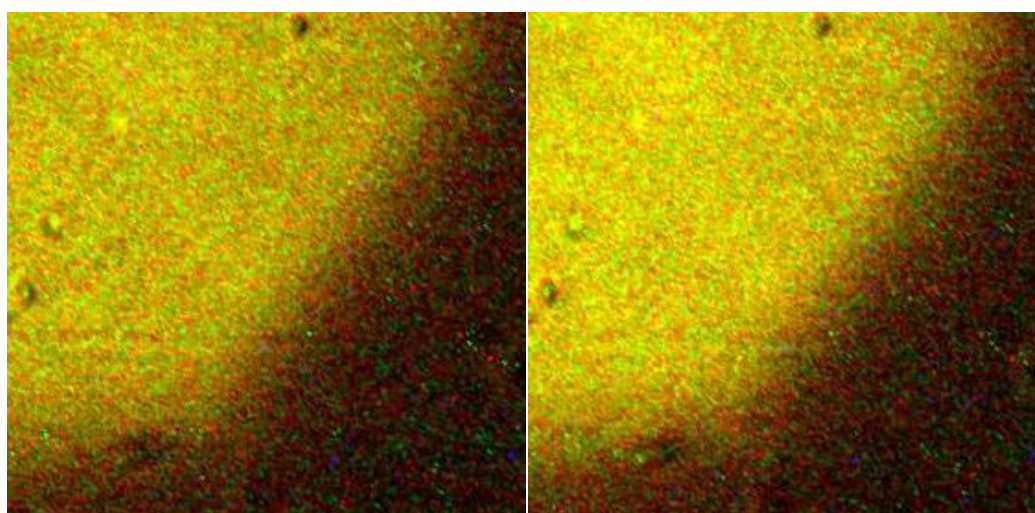


Figure 1 (a, b, c, d) the images selected from beginning, middle and last part of series

Below (Fig.2) are presented the magnified variants of 1b and 1c images (lower right corners).



2b (the lower right)

2c (the lower right)

Figure 2. (b, c) the magnified images of the lower right corners of 1b and 1c images.

As we're convinced observing microstructure of 1a, 1b, 1c and 1d images, the film consists of micro particles ensemble, having polarization sensitivity; they are self-induced, by film drying. The transparency of area with photoinduced anisotropy is a function of active light exposition. Every next single image is brighter than the previous. Its reaching of strong continuous form (Fig.1d) takes place by changing in structure (compare the images 2b and 2c).

3. Conclusion

Thus, based on provided investigations on polyvinyl film dyed by azodye "Mordant Pure Yellow", it is possible to conclude that in the process of film preparation by azo dye during the drying, the self-induction process of dye micro particles ensemble with polarization sensitivity takes place. As the result of acting on that film by active linearly polarized light the anisotropy photoinduction in form of "grains" takes place in the film. Depending on active light exposition the photoinduced anisotropy integral area is modulated and, as a result, anisotropy obtains the strong continuous form.

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