

OPTICAL PROPERTIES OF MESOPHASES AND MESOMORPHIC GLASSES OF Co²⁺ ALKANOATES HOMOLOGOUS SERIES

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Abstract. *The results of spectral studies of thermotropic ionic liquid crystals (TILC) of homologous series of cobalt alkanoates and their mesomorphic glasses are presented. It is shown that the dominant coordination of the cobalt ions in the investigated media is an octahedron. A significant decrease the absorption coefficient with increasing of the aliphatic chain length in the homologous series of cobalt alkanoates is caused by the decrease of the volume concentration of the cobalt cation complexes and the dipole moments of d-d-transitions.*

Keywords: cobalt alkanoates; ionic thermotropic liquid crystals; mesomorphic glasses; optical absorption spectra.

1. Introduction

Modern tendencies in holographic recording of information mostly associated with the developing of new multifunctional materials. One of such materials is metalalkanoates which form TILC during their melt. TILC are the universal matrixes for great number of organic and nonorganic materials. In particular, they are used for introduction of the different dyes in order to create medium for holographic grating recording.

Cobalt alkanoates are standing out of metalalkanoates series due their ability to absorb light in visible spectral region. Also, the important feature of these materials is ability to overcool with vitrification. Received glass state is characterized by preserving Liquid Crystal (LC) structure. Materials with preassigned characteristics can be established by varying length of cobalt alkanoates hydrocarbon chains.

2. Analysis of research and publications

Recently metalalkanoates are used for developing of new optical and nonlinear-optical materials [Bordyuh et al. 2009; Klimusheva et al. 2006; Binnemans 2005]. In particular, metalalkanoates serve as matrixes in composites for dyes and photosensitive impurities with great and fast nonlinear response.

Another perspective way of developing materials with improved nonlinear-optical characteristics on the basis of metalalkanoates is establishing of LC compounds with ions of d- and f-metals [Binnemans 2005; Bordyuh et al. 2009; Hartmut 2004]. It is common knowledge that ions of d- and f-metals are widely used for developing of nonlinear-optical materials [Binnemans 2005; Bordyuh et al. 2009].

Therefore it is necessary to study optical properties of cobalt alkanoates TILC and mesomorphic glasses.

Aim of the work is:

- development of preparation methods of liquid crystal cells and mesomorphic glasses based on cobalt alkanoates;
- determination of cobalt ions coordination, it's possible change depending on the temperature and physical state of matter (mesophase, mesomorphic glass).

3. Methods and objects of research

Electronic spectroscopy was used to study optical properties of cobalt alkanoates. Measurements were taken in the temperature range 20–150°C, towards increase and decrease of the temperature, with measurement pitch 3°C. Temperature was regulated by using specially constructed oven, which was situated in the monochromator chamber on the light path.

Electronic absorption spectra of cobalt alkanoates samples were studied in visible optical wavelengths diapason (400–700 nm) using automatic spectral setup CSOS-6 on the basis of monochromator MDG-6.

As the radiation detector for wavelength range $\lambda = 650\text{--}1200$ nm was used PED-62. Scanning of the spectrum was carried out using step engine, scanning pitch - 2.00 nm. Number of averaging was 1000.

Obtained spectrum of the intensity-transmittance wavelength relation was converted to the optical density wavelength relation using expression

$$D = \lg(I_0/I),$$