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Abstract. *The article represents the results of electrical conductivity studies of cobalt decanoate and lead decanoate oriented samples. It was determined that samples are weak electrolytes in the liquid crystal state region. The samples are characterized by great anisotropy of bulk conductivity caused by molecular order.*

Keywords: anisotropy of conductivity; cobalt alkanoate; conductivity; lead alcanoate; thermotropic ionic liquid crystals

1. Introduction

The research of new perspective materials for engineering and development of data processing and storage devices is one of the important directions of modern science elaboration.

Due to recent trends the great attention is paid to studies of untraditional types of liquid crystals (LC). The unconventional properties of these materials open up new possibilities for various practical uses. One of such properties with great practical importance is anisotropy of electrical conductivity.

2. Analysis of research and publications

Metal alkanoates $C_nH_{2n+1}COOM$ form thermotropic ionic liquid crystals (TILC) during their melt. One of the main features of TILC is intrinsic ionic conductivity. Despite this, there are almost no literature data [1-3] on the conductivity of oriented liquid crystal phase of TILC. In particular, the temperature dependence of the anisotropy of conductivity and anisotropy value oriented crystal are unknown. Also the impact of near-electrode phenomena on TILC conductivity is unclear.

The aim of the work is:

– investigation of electrical conductivity of TILC of cobalt decanoate and lead decanoate for determining its features;

– detection of the connection between electrical conductivity and structure of LC.

3. Methods and objects of research

The investigation of electric properties was conducted for samples of cobalt decanoate $(C_9H_{19}COO^-)_2Co^{2+}$ ($T_{melt}=82^0C$, $T_{clar}>300^0C$), and lead decanoate $(C_9H_{19}COO^-)_2Pb^{2+}$ ($T_{melt}=87^0C$, $T_{clar}=114^0C$).

The bulk electrical conductivity of all samples was determined by oscilloscopic method [4-7]. The triangular voltage signal had peak value of 0,10 – 0,25 V. The frequency dependence of bulk resistance for all examined samples was investigated in temperature range of LC formation. It was found, that in the frequency range $10^4 < f < 10^6$ Hz measured resistance almost does not depend on frequency. This indicates a uniform volume distribution of the voltage applied to the sample. Low values of alternating voltage applied to the samples made electrochemical processes on electrodes impossible.

Small-angle X-ray studies [8] have shown that LC phase of investigated materials belongs to Smectic A type. The molecules are packed in a bilayers formed by alkyl chains, among which are cation-anion interlayer - cations of cobalt (or lead) and the oxygen atoms of carboxyl groups with negative charge.

The cells with metal electrodes (Ni, Cu) were used for investigation of electrical conductivity of smectic TILC. The samples are characterized by strict homeotropic alignment [8], which allowed to investigate anisotropy of conductivity of TILC. Therefore, the electrodes in cells were placed relatively glass substrates either as a sandwich (Fig. 1a) or planar (Fig. 1b). The cell was filled with material by capillary method during its melting. To prevent the "absorption" of water in the sample cell