

## LIQUID CRYSTAL FORMATION AND OPTICAL PROPERTIES OF BINARY SYSTEMS BASED ON LANTHANUM (III) AND NEODYMIUM (III) LAURATES

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Metal alkanooates are known to be representatives of ionic metallomesogens, which form thermotropic and lyotropic liquid crystals (LC) and isotropic and mesomorphic glasses. The mesomorphic behavior of metal alkanooates, as shown in [1], is dictated by the so-called ionic mesogenicity criteria, i.e., the size-to-charge ratio of the metal cation and the chain length of the alkanooate anion. These criteria were deduced from an analysis of the mesomorphic behavior of uni- and divalent metal alkanooates. Applying these criteria to trivalent metal alkanooates, one should expect LC to form upon melting of rare-earth metal alkanooates. Experimentally, this was proven in [2-5] during the study of the phase behavior of lanthanum, neodymium, praseodymium, and cerium alkanooates.

### Table

Phase diagram peculiarities of the binary systems  $x\text{La}+(100-x)\text{M} | \text{C}_{11}\text{H}_{23}\text{COO}$

Binary system	Mesophase existence range, x, mol%	Glasses formation range, x, mol%	Diagram peculiarities, T, °C at x, mol%
La+Li   $\text{C}_{11}\text{H}_{23}\text{COO}$	$25 < x \leq 100$	$20 < x \leq 100$	Eutectics: 104, x=52; 102, x=80 Dystectics: 118, x=66 Peritectics: 110, x=45
La+Na   $\text{C}_{11}\text{H}_{23}\text{COO}$	$0 \leq x \leq 100$	$10 < x \leq 100$	Eutectics: 116, x=26; 96, x=60 Dystectics: 128, x=40
La+Tl   $\text{C}_{11}\text{H}_{23}\text{COO}$	$0 \leq x \leq 100$	$10 < x \leq 100$	Eutectics: 88, x=73; 95, x=65 Dystectics: 118, x=50
La+Pb   $\text{C}_{11}\text{H}_{23}\text{COO}$	$0 \leq x \leq 100$	$20 < x \leq 100$	continuous solid solution with min at 75, x=40
La+Cd   $\text{C}_{11}\text{H}_{23}\text{COO}$	$0 \leq x \leq 100$	$10 < x \leq 100$	Eutectics: 85, x=45
La+Zn   $\text{C}_{11}\text{H}_{23}\text{COO}$	$35 < x \leq 100$	$50 < x \leq 100$	Eutectics: 75, x=70

In the present work the phase diagrams of the binary systems of lanthanum (III) laurate with uni- (lithium, sodium, and thallium) and divalent (zinc, cadmium, lead) metal laurates have been examined in order to determine the temperature and concentration ranges of ionic mesophase and mesomorphic glass formation and to establish the major

regularities of mesophase and glass formation in binary systems with different-valence metal cations (see table).

This study is important for developing new LC and glassy materials with specific optical and spectroscopic properties [5].

So, our investigation of phase equilibria in the binary systems of lanthanum laurate with univalent metal (Li, Na, Tl) laurates has shown that the mesophase clearing curves show a well-defined negative anomaly, i.e. a negative deviation from the additive straight line joining the mesophase clearing temperatures of the pure components. In the system with nonmesogenic lithium laurate, there is some anomalous increase in the mesophase clearing point in the concentration existence range of the incongruently melting compound. The mesophase clearing curves in the system of lanthanum laurate with lead laurates really correspond with the additive straight lines joining the mesophase clearing temperatures of the pure components. Thus substitution of lanthanum cations by divalent metal cations causes the lesser extent of the lanthanum laurate mesophase destruction than in the case of such substitution by univalent metal cations.

The optical absorption spectra of Nd (III) in the binary laurate systems have been measured as a function of temperature, cationic potential and phase state of laurate matrix (melt, mesophase, glass). Absorption bands of spectra Nd (III) [5] correspond to successive f-f-transition:  $^4I_{9/2} \rightarrow ^4G_{5/2}$ ,  $^2G_{7/2}$  at 580 nm,  $^4I_{9/2} \rightarrow ^4G_{7/2}$  at 522, nm,  $^4I_{9/2} \rightarrow ^2K_{13/2}$  at 510 nm,  $^4I_{9/2} \rightarrow ^2H_{11/2}$  at 610 nm. It has been established that the optical absorption at 582 nm relates to “supersensitive transition”. It decreases smoothly in the mesophase with heating and exhibits sharp drop at clearing point when mesophase goes into isotropic melt. With increasing in mean cationic potential of laurate liquid crystalline matrix there is a decrease in bond covalency of Nd (III) cations with laurate anions, that favours to an increase in symmetry of their local environment.

#### References:

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