Lyotropic mesophases as template for d-, f – elements nanoorganisation

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The major strategy of modern synthesis nanostructure materials is utilized of processes of spontaneous self-organizing. In this aspect liquid crystal (LC) systems use as template, allows carrying out the control of architecture and the size received nanomaterials are perspective. Moreover liquid crystal state also allows operating its physical properties in macro scale by apply low external fields.

In this work we had been developed techniques of synthesis lanthanide containing systems based surfactants: $C_{12}H_{25}O(CH_2CH_2O)_{10}H$ ($C_{12}EO_{10}$), $C_{12}H_{25}O(CH_2CH_2O)_4H$ ($C_{12}EO_4$), $CH_3(CH_2)_{11}N(O)(CH_3)_2$) ($C_{12}$DMAO), possessing stable lyotropic mesophase in various solvents in a wide concentration and temperature interval. The phase behavior was studied by POM, DSC methods. The structure of the mesophase was estimated by SAXS. Phase diagrams for ternary systems $C_{12}EO_{10}$ or $C_{12}EO_4$ /Ln(III)/H_2O were drawn. Systems based on $C_{12}EO_{10}$ forms hexagonal mesophase, while systems based on $C_{12}EO_4$ exhibits lamellar molecular order. It is necessary to notify that phase transition temperature (LC-isotropic liquid) of the systems based on $C_{12}EO_4$ generally is higher to be compared with $C_{12}EO_{10}$ systems. The systems C_{12}DMAO:La(III)/H_2O/$C_{10}H_{21}OH$ depends on molar ratio Sur:Ln forms different mesophase – hexagonal, lamellar and nematic in various concentrations regions.

Using complex researches on different organization levels (from molecular to micellar, transformation of micellar aggregates from sphere to cylinder and in LC state of matter) was carried out. Self-organization of $C_{12}EO_{10}$ or $C_{12}EO_4$ water solutions in presence of lanthanide ions in wide temperature and concentration range was studied by means of tensiometry, conductivity, rheometry, dynamic light scattering and ^{1}H NMR. Influence of lanthanide ions on surfactant self-organization was proved out.

Techniques of obtaining thin film with nanoorganized lanthanide ions from aligned and nonaligned lyotropic systems are suggested. Metal nanoorganization and its environment it is investigated by methods AFM, SEM, TEM. Influence of lanthanide ion (Eu(III), Tb(III)), organic ligand ($C_{12}EO_{10}$, $C_{12}EO_4$, C_{12}DMAO) and solvent (H_2O, D_2O) on organization in mesophase were studied by the means of time-resolved spectroscopy. Time-resolved luminescence spectra and luminescence lifetime decay curves were obtained, luminescence lifetime values were calculated. For the first time influence of type supramolecular organizations on efficiency of a luminescence in similar systems is established. The opportunity of management by photophysical properties by a variation of type organic ligand, solvent, temperature and a degree of orientation mesophase is shown.

On the basis of synthesized lyomesophases, containing nanoorganized ions Eu (III) and Tb (III) conditions of technology of creation effective luminescent materials are developed.

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