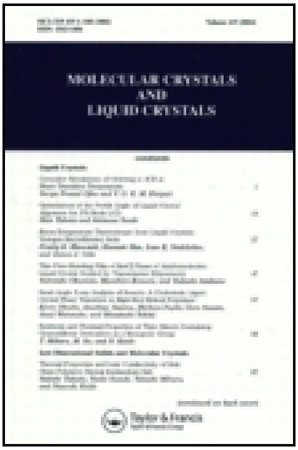

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Influence of Molecular Structure of Optically Active Dopant on Spontaneous Polarization Value in Induced Ferroelectric Systems

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INFLUENCE OF MOLECULAR STRUCTURE OF OPTICALLY ACTIVE DOPANT ON SPONTANEOUS POLARIZATION VALUE IN INDUCED FERROELECTRIC SYSTEMS

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Abstract The influence of molecular structure of optically active nonmesogenic ℓ-menthyl derivatives on spontaneous polarization value in induced ferroelectric systems based on salicylidenes was investigated.

Recently one of the progressive ways of creation of new ferroelectric liquid crystalline materials is the induced spiral twisting in tilted smectics by chiral dopants with transverse dipole moments. It was shown[1] that for creation of the induced ferroelectric systems with high value of spontaneous polarization it is possible to choose the compounds (as a matrix and a dopant) with a similar chemical structure.

In this paper the results of the investigated binary systems, both components of which belonged to 4 - alkoxysalicylidenes series, are presented. 4 - pentyloxysalicylidene - 4'- n - pentylaniline, characterized by a wide temperature range of smectic C phase and a good chemical stability, was used as a liquid crystalline matrix. The homologous series (n = 1-8) of 4 - alkoxy-salicylidene - 4'- (aminobenzoate) - ℓ- menthol (OAD-I) and 4 - alkoxy-salicylidene - 4'- (aminocinnamoate) - ℓ- menthol (OAD-II) were used as optically active dopants which differ from each other by the flat fragment -CH=CH- in the molecule of cinnamoate. The selection of these components of systems is conditioned by geometrical similarity of main fragments of molecules, which enable to arrange these molecules in compact intermolecular association.

The spontaneous polarization P_s measurements were made according to the oscillogrammes of the polarization reversal in the alternating electrical field by a modified Sowyer - Tower method[2] in samples with the homogeneous planar orientation microscopically controlled. The magnitude P_s is saturated in the 10° temperature range below the chiral smectic C transition point with decreasing temperature.

Dependences of P_s saturation value on amount of carbon atoms in alkoxyradical of optically active dopants molecule at 20% weight concentration for OAD-I (•) and for OAD-II (x) are presented in Fig.1.

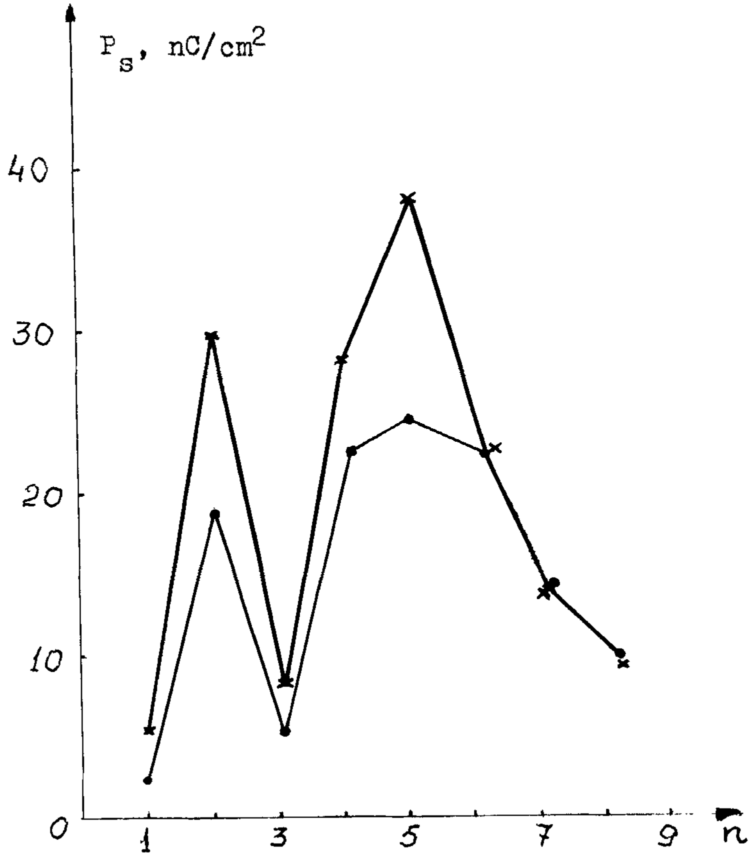

Fig.1

As it was shown in Fig.1, the value of spontaneous polarization of binary system depends on the ratio of the molecular length of alkoxyradical of matrix and of chiral dopant. P_s reaches the maximum, when these lengths equalize (n = 5). Probably, in this case the most favourable conditions for summing up the transverse dipole moments of components of mixture are created. Thus the intermolecular association with optimal transverse dipole is formed.

One may connect the observed non-smooth change of the $P_s(n)$ with the even-odd effect.

The energy of intermolecular interaction is probably increased by the presence of the flat fragment of OAD-II series since the P_s values are 1.5 - 2 times larger.

The investigations carried out are important either for understanding of physical process, which takes place in induced ferroelectric systems, or for elaboration of new ferroelectric liquid crystalline mixtures for electrooptical devices.

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