Electrophysical properties of doped ferroelectric films

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Ferroelectric polymers based on vinylidene fluoride (VDF), due to their specific properties and biocompatibility, are widely used in technology and medicine [1-4]. One of the applications of dye-doped PVDF is an "optode", which allows to detect a change in the absorption or luminescence spectrum of a material under the action of external reagents in a clinical analysis.

In this paper, changes of the electrical properties of VDF copolymer with hexafluoropropylene (HFP) are studied when porphyrin dye -tetraphenylporphyrin (TFP) - is introduced into it. It was found that even at a TFP concentration 0.005 wt. %, the dc conductivity σ_{dc} increases by more than an order of magnitude. This is accompanied by a shift of the dielectric dispersion associated with the Maxwell-Wagner polarization by two orders of magnitude into higher frequency region. An analysis of the temperature dependence of σ_{dc} shows that for both films there are several temperature regions where the data follow Arrhenius laws with different activation energies. DSC data show that the temperatures where the activation energy changes fall on the main region of crystal melting (in both films) and melting of the secondary crystals (in doped film). It is concluded that the TFP is located in amorphous regions and promotes the formation of secondary crystals increasing their fraction by 30%.

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