POLARIZATION PROFILES IN P(VDF-TFE) COPOLYMER STUDIED BY PPS AND LIMM METHODS

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It it known that the PPS method provides a spatial resolution of about 1-2μm. It means that profiles of polarization measured by this method in near-electrode zones is somewhat ambiguous. At the same time, the LIMM method was claimed to have an extremely high resolution of about 0.1μm near the illuminated surface, provived high modulating frequencies are used, although the resolution decreases sharply in the volume of the sample. Therefore, these two methods can be considered as complementary and providing together a comprehensive and reliable data on profiles of polarization. In this paper we report how the PPS and LIMM methods were applied to study distribution of polarization in RT poled 95/5 P(VDF-TFE) films of 20μm thickness. The samples were poled either in a corona triode, or by direct application of high poling field. Our results confirm that polarization is non-uniformly distributed if moderate poling field of about 60 MV/m is applied independently on the method of poling. A peak of polarization is shifted in this case to a positive electrode with almost half of the thickness remained unpoled. However, polarization is distributed uniformly, if high poling field of about 110-150 MV/m is applied. By switching of polarization in a moderate field one can obtain bimorph and even trimorph structures due to incomplete polarization switching at different cross-sections. Even in case of such complex profiles we observed very good agreement in data obtained by the two methods. The PPS method gave better overall picture of the polarization profile, while the LIMM method provided for a fine description of the profile near the illuminated surface. We found that even in uniformly poled samples, two symmetrical transition zones existed near surfaces of the samples where polarization decreased abruptly from its maximum to zero within a thin layers of about 1.5 μm followed by 0.5 μm-thick completely unpoled zones attached to the surfaces. One can speculate that the origin of the transition zones is related to stuctural inhomogenity, although injection and trapping of charges can also contribute to their formation.