

Depolarization radii of latent heavy-ion tracks in poly (vinylidene fluoride)

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Poly(vinylidene fluoride) (PVDF) is a ferro- and piezoelectric material with a high piezoelectric constant, being of interest for numerous technical applications. The piezoelectric activity mainly originates from aligned molecular dipoles in the crystalline regions. In our work, foils of poled β -PVDF are exposed to heavy ions (with kinetic energies of about one to several GeV), employing different ion species and fluences. Irradiation with energetic heavy ions reduces the crystallinity and in consequence also the remanent polarization. Adjacent irradiated and nonirradiated zones are provided by protecting part of each sample with a mask. A sinusoidal voltage applied to the foil causes a periodic thickness change on the nanometer scale whose size differs for irradiated and virgin areas. These oscillation amplitudes, monitored by line scans with a commercial profilometer, can be related to a mean depolarization radius of the damage trails of single ions. From a comparison with ion-track radii extracted from XRD and SAXS measurements we conclude that an ion track in poled PVDF consists of an amorphous core, surrounded by a concentric shell of still partially crystalline but depolarized material.