Study of hyperfine interactions in Perovskite structure $CaTiO_3$ with perturbed angular correlation spectroscopy

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Ceramic materials of the perovkista were identified as candidates for immobilization of medium and high levels of radioactive waste due to the fact that they are thermodynamically chemically and physically stable. Because it is a nuclear technique, PAC spectroscopy has great precision and efficiency in the measurement of local hyperfine fields on an atomic scale, constituting an ideal tool for the investigation of the atomic origin of structural phenomena, such as the influence of defects in the macroscopic properties of many materials or the local neighborhood of metallic atoms in the oxide structure. The samples has been prepared by sol-gel method and characterized by X-ray diffraction. In this study the time differential perturbed angular correlation (PAC) spectroscopy was used to study the structure of $CaTiO_3$ and the possible defects made by radiation exposure. The probe nucleus used in this research was ^{111}Cd. The PAC method is based on the hyperfine interaction of nuclear moments of the probe with extra nuclear magnetic fields or electric field gradients (EFGs). In the case of quadrupolar electric interaction, the experimental measurement gives the quadrupolar frequency ν_Q with respective distribution δ as well as the asymmetry parameter η of EFG. The γ-γ PAC measurements were carried out using a standard set up with four conical BaF_2 detector scintillators with a time resolution of 0.6 ns (FWHM).