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Synthesis and TDPAC Characterization of Multiferroics: The HoMnO3 Case

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Materials of the $RMnO_3$ (R is a rare-earth) multiferroic perovskite family show an extraordinary number of applications in technology, e.g., spintronic devices, data storage equipment, and sensors, thanks to properties like magnetically induced ferroelectricity. According to the literature, the Perturbed $\gamma-\gamma$ Angular Correlation (PAC) method is an available technique to study hyperfine interactions in material with such properties and can be used to identify phase transition due to its non-dependence on temperature variation, for instance. In addition, the orthorhombic $HoMnO_3$ is a promising multiferroic, but this material possesses a nonperovskite hexagonal phase. The synthesis of the orthorhombic phase requires high-pressure or soft chemistry routes that are hard to perform in any synthesis Lab. By considering this matter, we propose a sol-gel synthesis route for orthorhombic $HoMnO_3$ using different Cd and La percentage doping. Sample crystalline structures are then characterized by X-ray diffraction to determine hexagonal/orthorhombic phase proportion. After structural characterization, we analyze samples employing PAC spectroscopy using ^{111}Cd probes that are implanted and analyzed at the ISOLDE/CERN facility or during synthesis with ^{111}In at the Hyperfine Interaction Group - HIG laboratory at the Nuclear and Energy Research Institute - IPEN.

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