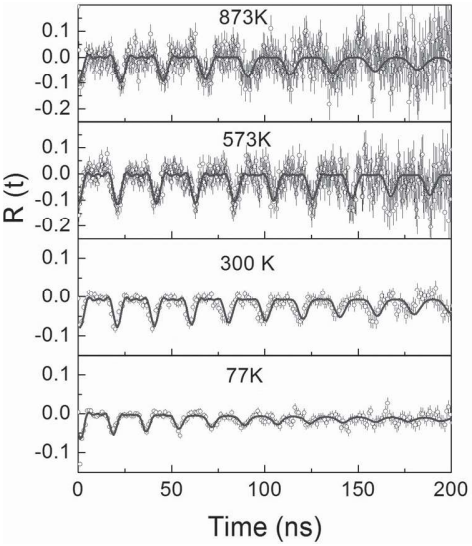
ordering, and metal-insulator transition. In this paper, we have used a nuclear and short-range technique, the Perturbed Angular Correlation (PAC) spectroscopy, to investigate the magnetic hyperfine field at the 140Ce nucleus of Ce impurities occupying La sites. The radioactive 140La nuclei with a half-life of 40.8 h were produced by direct activation of natural La present in the samples through the irradiation with neutrons in the IEA-R1 nuclear research reactor of IPEN. The PAC measurements were carried out with a six BaF2 detector spectrometer at several temperatures between 10 K and 400 K. This double perovskite samples were synthesized by sol-gel route. The crystal structure was determined by X-ray diffraction and the analyses showed that this method produced perovskite oxides with cubic structure in Pm-3m space group. This phase occurs due to an oxygen deficiency. The local properties investigated by PAC spectroscopy revealed a ferromagnetic transition temperature above 300 K and an anomalous behavior of the temperature dependence of magnetic hyperfine field at La sites, which can be ascribed to the contribution of 4f band of Ce to Bhf at low temperatures due to the increase in its localized character.

**GR-06. Engineering Magnetoresistance in (001)- and (111)-oriented $(La_{2/3}Sr_{1/3}MnO_3)_n/(LaFeO_3)_{10}$ Superlattices through Interfacial Coupling.** Y. Zhou[1,2] and *S.J. May*[2] *1. Materials Science and Engineering, Shandong University, Ji'nan, China; 2. Materials Science and Engineering, Drexel University, Philadelphia, PA, United States*

In $ABO_3$-based heterostructures, the coupling of $BO_6$ octahedral rotations across interfaces has been shown to play a significant role in magnetic ordering temperatures and magnetocrystalline anisotropy in complex oxide films. In this work, we synthesize and characterize $(La_{2/3}Sr_{1/3}MnO_3)_n/(LaFeO_3)_{10}$ superlattices, in which we vary the crystallographic orientation and the thickness of thin $La_{2/3}Sr_{1/3}MnO_3$ (LSMO) layers in order to investigate the role of octahedral coupling on magnetoresistance in manganites. The octahedral rotations in bulk $LaFeO_3$ are larger than those in bulk LSMO, which we hypothesize results in suppressed on the Mn-O-Mn bond angles in the interfacial regions of LSMO due to interfacial octahedral coupling. Oxide molecular beam epitaxy was used to deposit superlattices with $n = 7$, 10, and 14 on both (001)- and (111)-oriented $SrTiO_3$. The different crystallographic orientations allow for the octahedral coupling at the interface to be tuned, with weaker coupling anticipated for the (001)-interface than the (111)-interface as the *B*-site cations are bridged by 1 and 3 oxygen atoms, respectively, at these interfaces. In the $n = 14$ superlattices, the effect of orientation is minimal with both (001)- and (111)-oriented samples exhibiting similar Curie temperatures and magnetoresistance. As the ratio of interfacial to non-interfacial volume within the LSMO layers is increased by decreasing *n*, we find that the transition temperatures and the magnetoresistive behavior of the samples diverges. Larger ordering temperatures and reduced magnetoresistance are found in the (001) superlattices compared to the (111) superlattices. This result is consistent with octahedral coupling playing a more significant role at (111)-heterointerfaces, and points to a structure-driven approach to tuning interfacial magnetoresistance in complex oxide heterostructures. Yu Zhou was sponsored by the China Scholarship Council (CSC).

**GR-07. Study of the Local Magnetics and Electrics Properties at $Gd_2Ti_2O_7$ by PAC Spectroscopy and ab Initio Calculations.** E.L. Correa[1], L.F. Pereira[1], *W.L. Ferreira*[1], B. Bosch-Santos[1], L. Scalise[1], V. Gonçalves[1], R. dos Santos[1], J. Schell[2] and A.W. Carbonari[1,2] *1. Instituto de Pesquisas Energéticas e Nucleares, Universidade de São Paulo, São Paulo, Brazil; 2. ISOLDE, CERN, Geneve, Switzerland*

$Gd_2Ti_2O_7$ exhibits a complex magnetic behavior with a geometrically frustrated antiferromagnetic ordering below $T_N = 1.1$ K and a second magnetic transition at 0.7 K. In the work here reported, perturbed angular correlation (PAC) technique was used in order to measure electric quadrupole hyperfine interactions at $^{111m}$Cd probe nuclei on Ti sites. These experimental results along with those for magnetic hyperfine interactions at 155Gd previously reported from Mossbauer Effect spectroscopy were interpreted with electronic structure first-principles calculation. Single and doped-Cd cell simulations have been performed with potential linearized augmented plane waves methods and generalized gradient approximation from Perdew-Burke-Ernzerhorf embodied within the WIEN2k all-electron code. PAC measurements have exhibited $^{111m}$Cd probes occupying two fraction sites characterized by well-defined quadrupole frequencies (as shown in the spin-rotation spectra in the figure) with almost the same values for the corresponding electric field gradient (efg), however, with slightly difference in the asymmetry parameters. Theoretical efg's obtained for Cadmium atoms located at Gd or Ti sites of the pyrochlore structure indicate that both experimental hyperfine parameters corresponding to Cd at Titanium site.




**GR-08. Tunneling Magneto-Dielectric Effects of Crystalized Co-$BaF_2$ Nano-granular Films at MHz Frequencies.** *H. Kijima-Aoki*[1], Y. Cao[1], Y. Endo[1], N. Kobayashi[2], S. Ohnuma[2,1] and H. Masumoto[1] *1. Tohoku University, Sendai, Japan; 2. Research Institute for Electromagnetic Materials, Tomiya, Japan*

Magneto-dielectric effect is of great interest to application for electromagnetic device due to their low dissipation power and high frequency response. We have reported that the permittivity (ε) change by an external magnetic field (*H*), namely tunneling magneto-dielectric (TMD) effect, observed at room temperature in metal-insulator type nano-granular film[1]. Fluoride-based nano-granular films has potential to achieve high TMD effect due to their high electrical resistivity (ρ) and low tanδ(δ=ε″/ε′). Since an intergranular matrix by the metal-fluoride such as $MgF_2$[1] and $AlF_2$[2] has high stability of crystallization (high heat of formation energy), the film easily forms nano-granular structure. The origin of TMD effect has been accounted by spin-dependent charge oscillation caused by quantum mechanical tunneling between magnetic granules[3], so inter-granular matrix structure and its electrical properties are important. In this report, we have focused on crystal $BaF_2$ as intergranular matrix with dielectric constant of 7.8 easy to form ionic crystals, and structure and TMD effects of Co- $BaF_2$ nano-granular system film with highly crystallized $BaF_2$matrix have investigated. A series of Co-$BaF_2$ films with Co content from 0 to 42 at.% were prepared by rf-magnetron sputtering, where Co granules of 2-3 nm in diameter are dispersed in $BaF_2$ matrix. Intergranular $BaF_2$ matrix is well crystallized and its (1 1 1) axis is preferentially oriented to out of plane. From *M-H* curves, Co-$BaF_2$ films show superparamagnetic behavior. The ρ of Co-$BaF_2$ films with 42 at.%Co film is still high about 30 Ω2cm enough to measure ε. TMD ratio ($\Delta\varepsilon/\varepsilon_0$) was evaluated $(\varepsilon_{10kOe}-\varepsilon_0)/\varepsilon_0$, where $\varepsilon_0$ and $\varepsilon_{10kOe}$ is ε under zero-field and a in-plane magnetic field of 10kOe, respectively. The frequency where the maximum TMD effect increases from 400k to 1MHz with increasing Co contents. The maximum $\Delta\varepsilon/\varepsilon_0$ of Co-$BaF_2$ films is found to be 2-4 at.% for 26-42 at.%Co. The magnetic field dependence of $\Delta\varepsilon/\varepsilon_0$ is reasonably fitted to $(M/M_{10k})^2$-*H* curves, supported by spin-dependent tunneling process in nano-granular film[3].