Local inspection of magnetic properties in GdMnIn by measuring hyperfine interactions.

G. A. Cabrera-Pasca[2], J. F. Magno[2], W. L. Ferreira[1], A. C. Campos[1], B. Bosch-Santos[4], T. S. N. Sales[1], L. F. D. Pereira[1], A. Burimova[1], R. N. Saxena[1], R. S. Freitas[3], A. W. Carbonari[1]

[1]*Instituto de Pesquisas Energéticas e Nucleares, IPEN-CNEN/SP, 05508-000, São Paulo, SP, Brazil*
[2]*Faculdade de Ciências Exatas e Tecnologia (FACET), Universidade Federal do Pará, Campus de Abaetetuba, 68.440-000 Abaetetuba, PA, Brazil*
[3]*Instituto de Física, Universidade de São Paulo, 05314-970, São Paulo, SP, Brazil*

[4]*Material Measurement Laboratory, National Institute of Standards and Technology - NIST, Gaithersburg, MD 20899, USA*

$GdMn_2$ is a member of a series of Laves phase containing a rare-earth element and a magnetic 3*d*-transition metal with very peculiar magnetic properties[1]. Doping with a non-magnetic element such as indium affects these properties[2,3]. GdMnIn is reported to crystalize in the hexagonal $MgNi_2$-type structure presenting a spin-glass behavior with no magnetic order attributed to the triangular spin frustration of magnetic ions[3]. The observed absence of long-range interactions by magnetization measurements along with the almost impossible measurements with neutron diffraction due to the presence of Gd with very high neutron absorption cross section makes the investigation of local exchange interactions in this compound very difficult. In the present work, measurements of hyperfine interactions at In sites using ^{111}In(^{111}Cd) probe nuclei were carried out by perturbed angular correlations (PAC) technique to investigate the local magnetic exchange in GdMnIn compound. Results displayed in Fig. 1 for the behavior of the major component (V_{zz}) of the electric field gradient (efg) tensor and the distribution of electric quadrupole frequency (δ) show a strong instability of the electronic environment of In sites when temperature decreases indicating a Mn-In disorder. The weak magnetic hyperfine field at In sites also shown in Fig.1 with an anomalous temperature dependence below around 140 K along with the increase in the angle between B_{hf} and V_{zz} directions suggest a weak long-range exchange interaction.

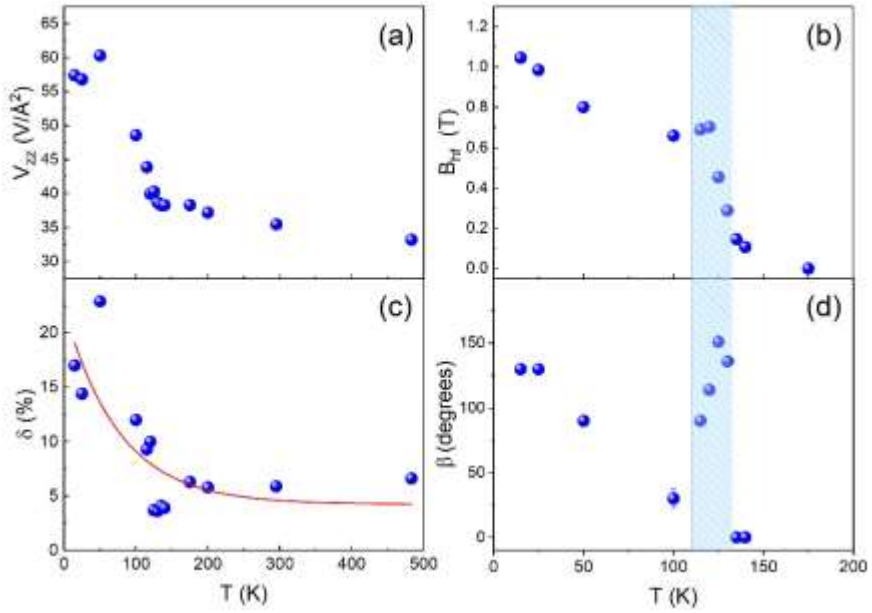

Fig. 1. Temperature dependence of the hyperfine parameters measured at In sites: (a) the major component of the efg tensor; (b) the magnetic hyperfine field; (c) the electric quadrupole frequency distribution; (d) the angle between the V_{zz} and B_{hf} directions.

References

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