

A SIX-BAF₂-DETECTORS PAC SPECTROMETER FOR MEASUREMENTS WITH SHORT LIVED NUCLEAR PROBES

Cláudio Domienikan¹, André L. Lapolli¹, Brianna Bosch-Santos¹, Artur W. Carbonari¹,
Rajendra N. Saxena¹, M. Roberto M. Schoueri¹

¹Instituto de Pesquisas Energéticas e Nucleares, IPEN-CNEN/SP, São Paulo, Brazil

Email:carbonar@ipen.br

A Perturbed Angular Correlation (PAC) spectrometer with six conical BaF₂ detectors was designed and built. The mechanical design conveniently accommodates a mini furnace and other cryogenic devices for sample measurements in a wide range of temperatures which, is quite important, particularly in the investigation of magnetic properties of samples. The standard multichannel analyzer (MCA) commonly used in these types of spectrometers was replaced with an ultra fast analog to digital converter (8715 ADC - CANBERRA[®]) and a high speed digital input-output (IO) board (6534 Acquisition system - NATIONAL INSTRUMENTS[®]). The experimental data consisting of relevant information about the delayed gamma-gamma coincidence events generated from different combinations of detectors are processed in the locally constructed Routing Unit (for example: the timing information, start and stop detector identification, coincidence validation etc.) and stored in a file-mode in the hard disk of a computer. This information can be processed at a later stage by background data processing to generate and periodically refresh individual PAC spectra without interruption of the data collection process. The coincidence spectra are generated in real time by using LabVIEW software. The increased number of simultaneous spectra generated in this spectrometer improves the precision of hyperfine parameters deduced from the PAC measurements, in particular for short half-life probes such as ¹⁴⁰Ce, ^{113m}Cd and ²⁴Mg produced from a nuclear reactor. As an example of utilization we show measurements of the temperature dependence of the magnetic hyperfine field on ¹⁴⁰Ce in LaMn₂Ge₂, which allowed to measure, for the first time, a precise value of the Curie temperature in this compound (see fig.1).

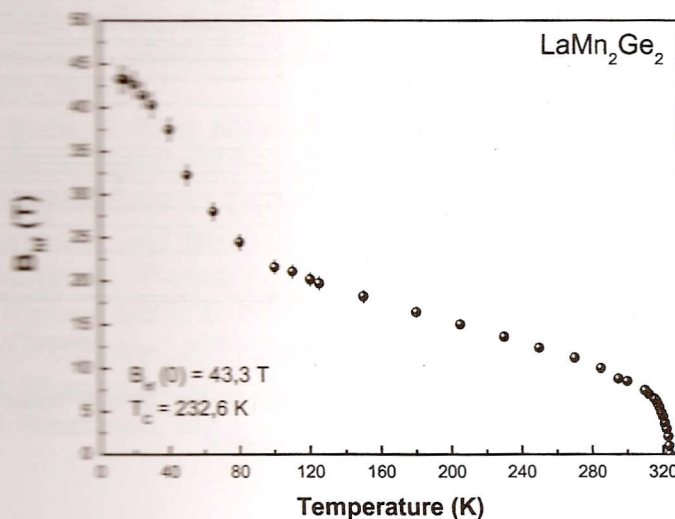


Fig. 1. Temperature dependence of the magnetic hyperfine field (B_{hf}) measured on ¹⁴⁰Ce at La sites in LaMn_2Ge_2 .