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The magnetic behavior of the intermetallic compound $NdMn_2Ge_2$ studied by magnetization and hyperfine interactions measurements

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ABSTRACT

The magnetic behavior of the intermetallic compound $NdMn_2Ge_2$ was investigated by bulk magnetization measurements and measurements of hyperfine interactions using perturbed γ–γ angular correlation (PAC) spectroscopy. Magnetization measurements indicate the presence of four magnetic transitions associated with the Mn and Nd magnetic sublattices. At high temperatures, magnetic measurements show a change in the slope of the magnetization due to an antiferromagnetic transition around $T_N \sim 425$ K and a well defined ferromagnetic transition at $T_C \sim 320$ K. Moreover, at ~210 K a peak is observed in the magnetization curve, which is assigned to the reorientation of the Mn spin, and at ~25 K an increase in the magnetic moment is also observed, which is ascribed to the ordering of Nd ions. PAC measurements using ^{140}La(^{140}Ce) and ^{111}In(^{111}Cd) probe nuclei allowed the determination of the temperature dependence of the magnetic hyperfine field (B_{hf}) at Nd and Mn sites, respectively. PAC results with ^{111}Cd probe nuclei at Mn sites show that the dependence of B_{hf} with temperature follows the expected behavior for the host magnetization associated with the magnetic ordering of Mn ions. From these results, the antiferromagnetic transition followed by a ferromagnetic ordering is clearly observed. PAC results with ^{140}Ce probe nuclei at Nd sites, however, showed a strong deviation from the Brillouin function, which is attributed to the Ce 4f-electron contribution to B_{hf}.

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