

NMR Measurements of Vortex Dynamics in Novel Superconductors

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Pulsed nuclear magnetic resonance (NMR) measurements have been performed on $\text{RNi}_2\text{B}_2\text{C}$ ($\text{R}=\text{Y}, \text{Lu}$) and MgB_2 samples to investigate vortex structure and dynamical behavior. Spectrum, linewidth and transverse relaxation rate $1/T_2$ of ^{11}B and ^{13}C NMR are measured and compared down to 3.8 K in a field range of 1 – 8 T. With lowering temperature below T_c , ^{11}B NMR spectrum, linewidth, and $1/T_2$ exhibit distinct features depending on vortex phases. Also, motional narrowing of linewidth and double-peak structure of $1/T_2$ supports significant thermal motion of vortices in $\text{RNi}_2\text{B}_2\text{C}$ superconductors. On the other hand, the same measurements for MgB_2 show less pronounced changes in NMR data relevant to vortex dynamics; $1/T_2(T)$ shows a single peak and the relaxation profile changes from Lorentzian decay to Gaussian decay at lower temperature. This strongly suggests that thermal fluctuation of vortices is reduced at low temperature. These results will be compared with NMR data of vortex dynamics for cuprate superconductors.

Keywords : Vortex dynamics, NMR measurements, $\text{RNi}_2\text{B}_2\text{C}$, MgB_2 , YBCO superconductor