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NMR study of the uranium-based filled skutterudite compound UFe_4P_{12}

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In the family of filled skutterudites, the only U-based compound successfully crystallized to date is UFe_4P_{12} . There is no other filled skutterudite including 5f electrons reported up to now. UFe_4P_{12} is isostructural with $PrFe_4P_{12}$, except for the replacement of Pr by U. The lattice constant is 7.7729 Å, which is the smallest value of all the filled skutterudite compounds. Magnetization measurements indicate the occurrence of ferromagnetic ordering with a relatively low Curie temperature $T_C \sim 3$ K [1]. On the other hand, the electrical resistivity increases nearly 7 orders of magnitude as T is lowered from room temperature to liquid helium temperatures [1,2] These results reveled that UFe_4P_{12} is a ferromagnetic insulator.

Recently, T.D.Matsuda *et al.* have performed detailed specific heat, magnetic susceptibility, and high-field magnetization measurements using a single crystal. They found that their experimental results were consistent with the crystalline electric field (CEF) scheme for T_h site symmetry, assuming a $5f^2$ configuration for the U.

In this study, we report microscopic magnetic properties of UFe_4P_{12} obtained via ^{31}P-NMR measurements [4]. The field-orientation dependence of the hyperfine interaction has been measured using a single crystal, and the results compared with a point-dipolar field calculation assuming local moments at the U sites. We have also measured the field and temperature dependence of the nuclear spin-lattice relaxation rate $(1/T_1)$ in several fields between 1.0 and 5.5 T at temperatures between 1.4 and 300 K. The results are discussed on the basis of a localized picture for the uranium 5f electrons.

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