Magnetic Phase Boundaries in β-$TeVO_4$: a ^{125}Te-NMR Study

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β-$TeVO_4$ has garnered significant attention for its complex magnetic behavior, which stems from its low-dimensional spin-½ chain structure. Magnetic vanadium ions are located in the slightly distorted square pyramids of VO_5 which share corners to form a zigzag pattern parallel to c-axis. Competing couplings J_1 being ferromagnetic (FM) and J_2 antiferromagnetic (AFM) create geometric frustration, and anisotropic intra chain interactions create a rich variety of long range ordered phases at low temperatures.

It is extensively studied by experimental and theoretical methods. At low magnetic fields, bulk methods and local probe ^{125}Te [1] and ^{17}O [4] nuclear magnetic resonance (NMR) and neutron scattering methods have revealed long range ordered incommensurate spin density wave (SDW), spin stripe and helical order. At high fields just below saturation magnetization at 22 T, an high field phase exists, which was first theorized to be an realization of multipolar spin nematic phase, but was later demonstrated to show characteristics of thermally driven dipolar order [3]. In addition to complex phase diagram, a new type of excitations has been found unique to the striped phase [2].

We present new ^{125}Te NMR data up to 17.4 T field range, which can be complementary to already published ^{17}O and muon resonance results. NMR line shift and shape behave expectedly over the paramagnetic to SDW phase transition. Relaxation measurements on ^{125}Te nucleus prove to be more sensitive then ^{17}O to the dynamics of phase transition. T_1 also exhibits a trend breaking anomaly in the SDW phase, indicating an even more complex excitation behavior in β-$TeVO_4$.

References

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