Crystal dependence of the magnetic properties of an antiferromagnetic alternating chain compound F_5PNN

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An $S = 1/2$ organic radical F_5PNN forms a uniform chain structure at room temperature and the temperature dependence of the magnetic susceptibility is well reproduced by the Heisenberg antiferromagnetic alternating chain model with $2J/k_B = -5.6$ K and $\alpha = 0.4$ in the Hamiltonian of $H = -2J\sum_{i=1}^{N_A/2-1}(S_{2i} \cdot S_{2i-1} + \alpha S_{2i} \cdot S_{2i+1})$. Nonmagnetic ground state with the energy gap $\Delta = 3$ T was confirmed by the measurements of the magnetization curves. The specific heat measurements suggest the structural change occurring at about 5 K. Recently we found that the structural change occurs at different temperatures depending on the condition of the crystal growth. Some crystals show the structural change at about 3 K which is detected by the sudden change of the temperature dependence of the susceptibility. Above 5 K, the calculated values of the susceptibility for a uniform chain of $2J/k_B = -5.6$ K is identical with the ones for the alternating chain with $2J/k_B = -5.6$ K and $\alpha = 0.4$. For the crystals with lower structural transition temperature, we observed larger thermal and field hysteresis. In this presentation, we will report the magnetic behavior of crystals grown in different conditions, powdered samples, and deuterated samples. The structural transition temperature is unchanged after several thermal cycles but is enhanced above 5 K if we grind the crystals originally showed the transition at 3 K.