Magnetic Ordering of Antiferromagnetic Trimer System $2b{\cdot}3CuCl_2{\cdot}2H_2O$

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$2b{\cdot}3CuCl_2{\cdot}2H_2O$ (b=betaine, $C_5H_{11}NO_2$) is a first candidate for two-dimensional S=1/2 orthogonal antiferromagnetic trimer system; Cu^{2+} ions form trinuclear complexes which are normal each other. Removic-Langer *et al.* studied magnetic properties by means of magnetic susceptibility measurement and estimated intra- and inter-trimer magnetic interactions, $J_{\rm intra}/k_{\rm B} = -15$ K and $J_{\rm inter}/k_{\rm B} = -4$ K, respectively. We have performed specific heat and magnetization measurements under extreme conditions, low temperature and high magnetic field. The specific heat in a zero filed shows a sharp peak at 1.38 K corresponding to a long-range magnetic ordering, $T_{\rm N}$. The $T_{\rm N}$ shifts remarkably to lower temperature and suppresses as the magnetic field increases. Above 5 T, the specific heat has no anomaly down to 0.15 K. Magnetizations at 1.3 K ($< T_{\rm N}$) using pulse magnetic field increase linearly up to one-third that of saturation value ($M_{\rm s}{\sim}3.2$ $\mu_{\rm B}$/f.u.), and then clearly exhibit a plateau behavior with increasing magnetic field between 5 and 14 T. In this plateau region with some energy gap, the magnetic ordering seems to be disappeared. As the magnetic field exceeds the plateau region, the magnetization is once linear up to the saturation value above 22 T. We present and discuss the magnetic phase diagram of $2b{\cdot}3CuCl_2{\cdot}2H_2O$.