Magnetization Process of S=1/2 Antiferromagnetic Trimer System

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The complex spin system produced by ferromagnetic/antiferromagnetic coupled cluster (dimer, trimer, tetramer, ···) has demonstrated attractive magnetic properties depending on various magnetic interactions between the clusters. We have studied magnetization process in two kinds of S=1/2 antiferromagnetic trimer system with or without three-dimensional magnetic interaction between the trimers, $Cs_2Cu_3P_4O_{14}$ and $(C_5N_5H_6)_2{\cdot}Cu_3Cl_8{\cdot}4H_2O$. The magnetization processes using a pulse magnetic field up to 56 T at 4.2 K exhibit a common one-third plateau that of saturation magnetization caused by antiferromagnetic trimer system. The all magnetization process of $(C_5N_5H_6)_2{\cdot}Cu_3Cl_8{\cdot}4H_2O$ without the three-dimensional magnetic interaction between trimers can be explained using a simple S=1/2 trimer system with antiferromagnetic interaction ($J/k_B{\sim}20$ K). However, the unexpected magnetization process of $Cs_2Cu_3P_4O_{14}$ with $T_N = 10$ K cannot be described by the localized trimer model. The anomaly of specific heat at 10 K in a zero field shifts to lower temperature with increasing applied magnetic field and cannot be observed in the plateau region. We present the magnetic phase diagram of $Cs_2Cu_3P_4O_{14}$ and the possibility of field-induced magnetic ordering under high magnetic field.