

## $\mu$ SR Study on Ferromagnetic Properties of Rb Clusters Incorporated into Zeolite A

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In aluminosilicate zeolite A, the  $\alpha$  and  $\beta$  cages with the inside diameter of  $\sim 11$  and  $7$  Å, respectively, are alternatively arrayed in a cesium chloride structure. Recently, we newly found ferromagnetic properties in Rb clusters incorporated into zeolite A, when the average number of electrons per two cages,  $n$ , is at  $n > 4.0$  [1]. A ferrimagnetic model is tentatively proposed for Rb clusters, where nonequivalent magnetic sublattices of clusters are constructed in  $\beta$  and  $\alpha$  cages, respectively, with a simple cubic structure. These two sublattices are coupled antiferromagnetically with each other. This model is different from a spin-canting antiferromagnet of K clusters incorporated in  $\alpha$  cage of zeolite A. In the present work, we carried out  $\mu$ SR study for Rb clusters in order to investigate the detailed magnetic properties by using GPS at PSI-S $\mu$ S.

Figure 1 shows temperature dependence of zero-field  $\mu$ SR spectra of Rb clusters at  $n = 5.5$ . The Curie temperature,  $T_C$ , of this sample is  $\sim 5$  K. All spectra can be fitted by the sum of an exponential function and a constant background;  $A \exp(-\lambda t) + B$ . The muon-spin relaxation rate,  $\lambda$ s suddenly increases below  $T_C$ .

The longitudinal-field  $\mu$ SR spectra show a typical decoupling behavior at 1.6 K. Hence, the exponential-like relaxation is due to a static internal field. The ratio of the relaxation term to the total asymmetry,  $A/(A+B)$ , is estimated to be  $\sim 0.6$ . This value is reasonable enough to conclude that the major part of the sample volume is under the magnetic phase transition. In K clusters in zeolite A, a very fast relaxation term within  $\sim 0.1 \mu$ s was observed [2]. Such a fast relaxation is not observed in Rb clusters. This indicates that the origin of ferromagnetic properties has a difference between Rb and K clusters from the viewpoint of  $\mu$ SR study.

[1] T.C. Duan et al., J. Magn. Magn. Mater. **310** (2007) 1013.

[2] T. Nakano et al., this conference.

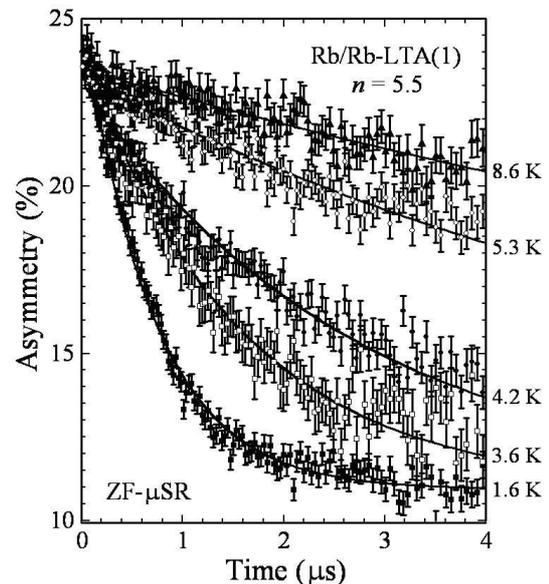


Fig. 1 Zero field MuSR spectrum of Rb clusters incorporated into zeolite A.