NUCLEAR SPIN CONVERSION OF CD$_4$ IN SOLID PARAHYDROGEN

Y. MIYAMOTO, M. FUSHITANI, H. HOSHINA, and T. MOMOSE, Division of Chemistry, Graduate School of Science, Kyoto University, Kyoto 606-8502, Japan.

Because of weak nuclear magnetic interactions, conversion between different nuclear spin states is a very slow process in the gas phase. On the contrary, the conversion in condensed phases is known to be quite fast. However, mechanism of the fast conversion in condensed phases has not been well understood yet. Last year at this meeting, we reported the nuclear spin conversion of CH$_4$ imbedded in solid parahydrogen.$^a$ We showed that the nuclear spin conversion in the solid is greatly accelerated by lattice vibrations of the crystal. Here, we report the nuclear spin conversion of CD$_4$ imbedded in parahydrogen solid. The rate of the nuclear spin conversion was obtained by the temporal change of rotation-vibration transition intensities of CD$_4$. Despite the small nuclear spin-nuclear spin coupling constant of CD$_4$ compared with that of CH$_4$, the conversion rate of CD$_4$ is found to be more than two times larger than that of CH$_4$ at the same temperature. In addition, the conversion of CD$_4$ shows stronger temperature dependence than that of CH$_4$. The difference of the nuclear spin conversion processes between CD$_4$ and CH$_4$ will be discussed.

$^a$M. Fushitani and T. Momose, 56$^{th}$ International Symposium on Molecular Spectroscopy.