PUMP AND PROBE SPECTROSCOPY OF CH$_3$F-(ortho-H$_2$)$_n$ CLUSTERS IN SOLID PARAHYDROGEN BY USING TWO CW-IR QUANTUM CASCADE LASERS

HIROYUKI KAWASAKI, ASAO MIZOGUCHI, HIDETO KANAMORI, Department of Physics, Tokyo Institute of Technology, Tokyo, Japan.

The absorption spectrum of the $\nu_3$ (C-F stretching) mode of CH$_3$F in solid para-H$_2$ by FTIR showed a series of equal interval peaks$^a$. Their interpretation was that the $n$-th peak of this series was due to CH$_3$F-(ortho-H$_2$)$_n$ clusters which were formed CH$_3$F and n's ortho-H$_2$ in first nearest neighbor sites of the para-H$_2$ crystal with hcp structure. In order to understand this system in more detail, we have studied these peaks, especially $n = 0 – 3$ corresponding to 1037 - 1041 cm$^{-1}$, by using high-resolution and high-sensitive infrared quantum cascade laser (QCL) spectroscopy. Before now, we have observed photochromic phenomena of these peaks by taking an advantage of the high brightness of the laser$^b$. However, it has not been revealed what kind of mechanism is undergoing in these processes. In order to solve this problem we introduced two cw-IR QCLs for pump and prove experiment. While the pumping laser is breaching a certain peak with high power, the probing laser is monitoring the increase of other peaks by rapid scan method. The time resolution of this spectroscopy is 5 msec. The new precise kinetic information will help us to understand the molecular interaction in solid para-H$_2$.