

HIGH RESOLUTION INFRARED SPECTROSCOPY OF CH₃F-(*ortho*-H₂)_n CLUSTER IN SOLID *para*-H₂

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The absorption spectrum of the ν_3 (C-F stretching) mode of CH₃F in solid *para*-H₂ by FTIR showed a series of equal interval peaks^a. Their interpretation was that the *n*-th peak of this series was due to CH₃F-(*ortho*-H₂)_n clusters which were formed CH₃F and *n*'s *ortho*-H₂ in first nearest neighbor sites of the *para*-H₂ 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 (QC) laser spectroscopy. Before now, we found many peaks around each *n*-th peak of the cluster, which we didn't know their origins^b. We observed photochromic phenomenon of these peaks by taking an advantage of the high brightness of the laser^c. In this study, we focus on satellite series consisting of six peaks which locate at the lower energy side of each main peak. All the peaks showed a common red shouldered line profile, which corresponds to partly resolved transitions of *ortho*- and *para*- CH₃F. The spectral pattern and time behavior of the peaks may suggest that these satellite series originate from a family of CH₃F clusters involving *ortho*-H₂ in second nearest neighbor sites. A model function assuming this idea is used to resolve the observed spectrum into each Lorentzian component, and then some common features of the satellite peaks are extracted and the physical meanings of them will be discussed.

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