DOPPLER-FREE TWO-PHOTON EXCITATION SPECTROSCOPY OF BENZENE IN A MOLECULAR BEAM

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The fluorescence quantum yield at the vibrational energy over 3000 cm^{-1} in the S_1 $^1B_{2u}$ state of benzene is dramatically decreased. This phenomenon is called "channel three" and has been studied extensively. We have observed the ultrahigh-resolution spectrum of the $S_1 \leftarrow S_0$ $1_0^2 14_0^1$ band (E_{excess} = 3412 cm^{-1}) and found the Zeeman splitting which explained to be originating from the magnetic moment of the S_1 state induced by mixing with S_2 state by *J-L* coupling. [a] [b] In this work, we established the apparatus for the Doppler-free two-photon excitation (DFTPE) spectroscopy with a molecular beam and measured the $S_1 \leftarrow S_0$ $1_0^1 14_0^1$ and $1_0^2 14_0^1$ band of benzene. When we measured the DFTPE spectrum in a gas cell, many rotational lines were observed but the pressure broadening was remained. On the other hand, when we measured the DFTPE spectrum in a molecular beam, the influence of collision was decreased. The typical linewidth was 6 MHz. The high-resolution and collision-free condition is useful to investigate the perturbing region with high sensitivity and accuracy.

[a] D. Y. Baek, J. Chen, J. Wang, A. Doi, S. Kasahara, M. Baba, and H. Katô, *Bul. Chem. Soc. Jpn.* ,**79**, 75 (2006).
[b] H. Katô, M. Baba, and S. Kasahara, *Bul. Chem. Soc. Jpn.*, **80**, 456 (2007).