ROTATIONALLY RESOLVED HIGH-RESOLUTION LASER SPECTROSCOPY OF THE $S_1 \leftarrow S_0$ TRANSITION OF NAPHTHALENE AND Cl-NAPHTHALENE

SHUNJI KASAHARA, RYO YAMAMOTO, KOHEI TADA, *Molecular Photoscience Research Center, Kobe University, Kobe 657-8501, Japan*.

Rotationally resolved high-resolution fluorescence excitation spectra and the Zeeman effects of 0-0 band of $S_1 \leftarrow S_0$ electronic transition have been observed for naphthalene, 1-Cl naphthalene (1-ClN), and 2-Cl naphthalene (2-ClN). Sub-Doppler excitation spectra were measured by crossing a single-mode UV laser beam perpendicular to a collimated molecular beam. The typical linewidth was 25 MHz and the absolute wavenumber was calibrated with accuracy 0.0002 cm^{-1} by measurement of the Doppler-free saturation spectrum of iodine molecule and fringe pattern of the stabilized etalon. For naphthalene [a] and 2-ClN, the rotationally resolved spectra were obtained, and these molecular constants were determined in high accuracy. The obtained molecular constants of 2-ClN are good agreement with the ones reported by Plusquellic *et. al.* [b] For 1-ClN, the rotational lines were not completely resolved because the fluorescence lifetime is shorter than the one of 2-ClN. Additionally, we have observed the change of the spectra with magnetic field. The Zeeman broadening was mainly observed for the levels of low K_a and increasing in proportion to J for given K for both of naphthalene and 2-ClN. The order of magnitude and the J, K-dependence of the observed Zeeman broadening were similar to the other vibronic bands of naphthalene. [c]

[a] D. L. Joo, R. Takahashi, J. O'Reilly, H. Katô, and M. Baba, *J. Mol. Spectrosc.*, **215**, 155 (2002).
[b] D. F. Plusquellic, S. R. Davis, and F. Jahanmir, *J. Chem. Phys.*, **115**, 225 (2001).
[c] H. Katô, S. Kasahara, and M. Baba, *Bull. Chem. Soc. Jpn.*, **80**, 456 (2007).