OBSERVATION OF HIGHLY EXCITED VIBRATIONAL LEVELS OF SiH_2 BY STIMULATED EMISSION PUMPING SPECTROSCOPY

H. ISHIKAWA, Y. MURAMOTO, and N. MIKAMI, *Department of Chemistry, Graduate School of Science, Tohoku University, Sendai 980-8578, Japan*.

SiH_2 is one of the simplest silicon containing radicals. Similarity and dissimilarity to CH_2 radical are very interesting from both chemical and spectroscopic points of view. Renner-Teller interaction between the $\tilde{A}\ ^1B_1$ and the $\tilde{X}\ ^1A_1$ states and an energy separation between the $\tilde{X}\ ^1A_1$ and the $\tilde{a}\ ^3B_1$ states are very important issues in spectroscopy. An analysis of highly excited vibrational levels in the $\tilde{X}$ state should provide some valuable information about them. Thus, we have carried out stimulated emission pumping (SEP) spectroscopy on SiH_2.

In the present study, a pulsed discharge nozzle was used to generate jet-cooled SiH_2 radical. Precursor of SiH_2 radical was phenylsilane. The 0_{00} rotational levels of the $\tilde{A}(060)$ and (070) levels were used as intermediate levels in the present SEP spectroscopy.

Until now, vibrational levels with v_2 up to 4 ($E_{vib} \leq 4000$ cm^{-1}) have been observed [a]. In the present study, 22 vibrational levels in the energy region of 4800 – 8000 cm^{-1} were observed. Due to strong $2\nu_2$:$1\nu_1$ Fermi and $2\nu_1$:$2\nu_3$ Darling-Dennison resonances, vibrational levels having the same polyad quantum number, $P = 2v_1 + v_2 + 2v_3$, construct polyad structures. The vibrational levels observed belong to polyads of $P = 5 - 8$. Taking these resonance into account, vibrational analysis of the SiH_2 radical was carried out. In the present analysis, vibrational constants, x_{13} and x_{23}, could be determined experimentally, for the first time. Preliminary values are -74.83 cm^{-1} and -17.58 cm^{-1}, respectively. Details of the vibrational analysis will be discussed at the presentation.

---

[a] H. ISHIKAWA and O. KAJIMOTO, J. Mol. Spectrosc. 174, 270 (1995).