FOURIER TRANSFORM MICROWAVE SPECTROSCOPY OF TiCℓ

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In a previous submillimeter - wave study, we have observed the pure rotational spectra of TiCl of J'' = 41.5 – 62.5 in the 400 – 600 GHz region, and obtained the accurate rotational constants for $Ti^{35}Cl$ (v = 0, 1, 2) and $Ti^{37}Cl$ (v = 0). Because of high rotational states, no hyperfine structure was resolved. The hyperfine coupling parameters carry pertinent information on the electronic structure. For this reason, we have attempted to observe the lowest rotational transitions in the 24 – 34 GHz region using a Fourier transform microwave spectrometer at the University of Tokyo.

TiCl was generated from mixed gas of 0.1 % $TiCl_4$ and Ar with backing pressure about 3 atm in a pulsed discharge. Discharge voltage was 2 kV. For both $Ti^{35}Cl$ (v = 0, 1) and $Ti^{37}Cl$ (v = 0) species, the three rotational transitions, J = 2.5 – 1.5, 3.5 – 2.5 for $\Omega = 3/2$ and J = 3.5 - 2.5 for $\Omega = 5/2$, have been observed with clearly resolved hyperfine structures at very close frequencies predicted from the submillimeter - wave spectra. Preliminary hyperfine coupling constants and the improved rotational constants have been obtained.