

THE PURE ROTATIONAL SPECTRUM OF TiCl^+ ($X^3\Phi_r$) BY VELOCITY MODULATION SPECTROSCOPY

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The pure rotational spectrum of the molecular ion TiCl^+ ($X^3\Phi_r$) has been measured using millimeter-wave direct absorption methods incorporating velocity modulation techniques. This species is the first metal-containing molecular ion observed with millimeter-wave velocity modulation spectroscopy. TiCl^+ was created in an AC glow discharge of gas-phase TiCl_4 and argon. Ten, eleven, and nine rotational transitions of $^{48}\text{Ti}^{35}\text{Cl}^+$, $^{48}\text{Ti}^{37}\text{Cl}^+$, and $^{46}\text{Ti}^{35}\text{Cl}^+$ were measured, respectively, in the frequency range of 323 to 424 GHz. All three spin-orbit components were observed. The irregular fine structure splittings indicate that two spin-orbit ladders are perturbed by an excited $^3\Delta_r$ electronic state. Rotational, spin-orbit, and spin-spin parameters have been determined from the data and agree well with past optical studies. This study illustrates the power of velocity modulation for ion selectivity at millimeter/sub-mm wavelengths.