THE ELECTRONIC SPECTRUM OF TANTALUM METHYLIDYNE, TaCH

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Tantalum methylidyne, TaCH, has been produced in a supersonic free jet expansion in helium by the reaction between laser ablated tantalum and methan e. TaCD has been made similarly using CD_4.
Pulsed dye laser excitation spectra from the $\Omega{=}0^+(\tilde{X}^1\Sigma^+)$ state of TaCH have been assigned to two electronic transitions whose upper states have $\Omega{=}0^+$, which probably is $^3\Pi$, and $\Omega{=}1$. The $(0,0)$ bands of these states lie at $15638.6\,\mathrm{cm}^{-1}$ and $16398.3\,\mathrm{cm}^{-1}$, respectively.
Wavelength resolved fluorescence emission from the $\Omega{=}0^+$ excited state has revealed a low lying $\Omega{=}1$ electronic state $3620\,\mathrm{cm}^{-1}$ above the ground state; this appears to be a $^3\Delta_1$ state. Two of the $\tilde{X}$ state vibrational fundamentals have been determined for TaCH(TaCD): $\nu_2 = 641(492)\,\mathrm{cm}^{-1}$ and $\nu_3 = 955(910)\,\mathrm{cm}^{-1}$. The values determined for the $a^3\Delta_1$ state were $\nu_2 = 606(449)\,\mathrm{cm}^{-1}$ and $\nu_3 = 925(864)\,\mathrm{cm}^{-1}$.
High resolution spectra are being recorded for selected bands; these will allow the molecular structure and the spectroscopic parameters to be determined accurately. The magnetic and quadrupolar hyperfine structure of ^{181}Ta is fully resolved in the high resolution study.

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