

A DIGITAL TELLURIUM ATLAS FOR SPECTRAL CALIBRATION, 19000 – 24000 cm⁻¹

JOSEPH M. CARDON, TONY SMITH, DENNIS CLOUTHIER, *Laser Research Laboratory, Ideal Vacuum Products, LLC, Albuquerque, NM, USA*; AMANDA J. ROSS, *Inst. Lumière Matière, Univ Lyon 1 & CNRS, Université de Lyon, Villeurbanne, France*.

We propose a digital record of the absorption spectrum of ¹³⁰Te₂ vapour as an aid to calibration of laboratory spectra currently referenced to the paper atlas of Cariou and Luc^a. The strong and crowded A0_u⁺ – X0_g⁺ bands of Te₂ have long provided useful benchmarks for calibration beyond 20000 cm⁻¹, where room-temperature B – X I₂ absorption cuts off. Molecular tellurium offers more lines per wavenumber than atomic uranium, whose atlas is also useful in this region.^b

Absorption spectra were recorded through the emission port of a Fourier transform spectrometer, using an external sample and light source. The sample was a sealed, evacuated 10-cm cell containing a small quantity of ¹³⁰Te₂. The cell was heated to temperatures between 600 and 640 °C, generating tellurium vapour pressures 8-11 Torr, to produce strong absorption without saturation. Optical filters were used to select 2000 cm⁻¹ spectral sections; interferograms were taken at nominal apodized resolution of 0.02 to 0.033 cm⁻¹. The pieces were spliced together to cover the range 19000 – 24000 cm⁻¹. The wavenumber scale was fine-tuned to match earlier (and sometimes absolute) reference data^{acde}. Measured linewidths of isolated peaks vary from 0.04 to 0.09 cm⁻¹, *i.e.* broader than expected from Doppler broadening and instrumental resolution considerations, but we believe the wavenumber scale to be good to ± 0.005 cm⁻¹.

Ascii data files with Te₂ transmittance and absorbance data are freely available for download from J. Mol. Spectrosc.,^f and from the Mendeley database, at <https://data.mendeley.com/datasets/kmkbwtjhd3/1>.

^aAtlas du spectre d'absorption de la molécule de téllure, Luc & Cariou, Laboratoire Aimé Cotton, CNRS publications, (1980)

^bA uranium atlas, from 365 to 505 nm; Ross *et al.* J Mol Spectrosc 369 111270 (2020)

^cAbsolute wavelength determinations in molecular tellurium: new reference lines for precision laser spectroscopy, Gillaspay and Sansonetti, J. Opt. Soc. Am. B 8, 2414 (1991)

^dAbsolute wavenumber measurements in ¹³⁰Te₂: reference lines in the 420.9 to 464.6-nm region, Scholl *et al* J. Opt. Soc. Am. B 22(5), 1128 (2005)

^eCavity dispersion tuning spectroscopy of tellurium near 444.4 nm, Coker *et al* J. Opt. Soc. Am. B 28 (12), 2934 (2011)

^fTe₂ absorption spectrum from 19000 to 24000 cm⁻¹, Ross and Cardon, J. Mol. Spectrosc. 384 (2022) 111589