

All data taken at Pacific Northwest National Laboratory (PNNL)

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Composite spectrum for MXYLENE_50T

Effective burden of composite spectrum: 1 part-per-million-meter (ppm-meter) at 296 K

Equivalent concentration x path-length of composite spectrum: 4.371×10^{-6} grams/liter-meter

Sample Conditions-

- Chemical name and CAS number: m-Xylene, 1,3-dimethylbenzene, 1,3-xylene, $(\text{CH}_3)_2\text{C}_6\text{H}_4$: [108-38-3]
- Physical properties: M.W. 106.167 amu, F.P. -47.9°C , B.P. 139.1°C , Density (20 C) 0.8684 g/cm^3
- Supplier and stated purity: Aldrich, 99+%
- Sample class: I (PNNL scale).
- Temperature of White cell (815.76 cm optical path length) $50 \pm 2 \text{C}$
- Diluent (high purity nitrogen) flowed at 25.20 liter/min (21.1°C), ambient atmospheric pressure $760 \pm 5 \text{Torr}$.
- Samples flowed at 5.000, 1.000, 10.000, 20.000, 3.000, 50.000, 30.000, 15.000, 40.000, 7.000, 12.000 and 25.000 microliters/minute
- Individual samples at equivalent pressures of 0.029570, 0.005915, 0.059140, 0.118280, 0.017744, 0.295739, 0.177490, 0.088757, 0.236685, 0.041431, 0.071034 and 0.148026 Torr. Final data is a composite spectrum.
- Preparation: None

Instrument Parameters-

- Bruker-66V FTIR, evacuated optics bench.
- Modified to include second aperture, between interferometer output and White cell. This substantially reduces both "ghosting" and warm aperture effects.
- Spectral range: 6,500 to 580 cm^{-1} (1.538 to 17.241 microns)
- Instrumental resolution based on maximum interferometer displacement is 0.112 cm^{-1}
- Spectral interval after 2X zero-filling interferogram and FFT: 0.06 cm^{-1}
- Interferogram zero-fill: 2X
- Apodization: Boxcar
- Phase correction: Mertz
- Beam splitter: Potassium bromide (KBr)
- IR source: Carbide glowbar (22 V)
- Scanner velocity: 60KHz (HeNe crossing frequency)
- Number of interferograms averaged per single channel spectra: 256
- Detector: Mid-band HgCdTe, photoconductive, 77K operation
- Folding limits: 15798 to 0 cm^{-1}

Post Processing and Related Parameters-

- Non-linearity detector correction (Bruker proprietary) applied to interferogram ($\alpha=0.90$, $\epsilon=500$)
- Composite spectrum created from 12 individual absorbance (base-10) spectra via classical least squares fit: Intercept=0, slope is fitted, individual absorbance values weighted by T^2 (transmission squared), all absorbance values ≥ 1.6 are given zero weight
- Calculated and estimated errors: Type A = 0.21%, Type B $\leq 7\%$

- Frequency correction (already applied): $V(\text{corrected})=V(\text{instrument})*0.9999987-4.24224\times 10^{-4}$
- Axis units: X=wavenumbers (cm^{-1}), Y=Absorbance (base-10)
- Trace water vapor features removed by spectral subtraction
- Baseline correction via 7th order polynomial subtraction