

All data taken at Pacific Northwest National Laboratory (PNNL)

Operators: Steven W. Sharpe, Timothy J. Johnson and Robert L. Sams : sw.sharpe@pnl.gov

Version 1.0, December, 04

Composite spectrum for ISOBUTENAL_25T

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

Equivalent concentration x path-length of composite spectrum: 2.8857×10^{-6} grams/liter-meter

Sample contained 6.21% propionaldehyde and 0.58% water. Composite spectrum corrected by rescaling and spectral subtraction.

Sample Conditions-

- Chemical name and CAS number: 2-Methyl-2-propanal, isobutenal, methacrolein, 2-methylacrolein, 2-methylpropanal, methacrylaldehyde, $\text{CH}_3\text{C}(=\text{CH}_2)\text{CH}=\text{O}$: [78-85-3]
- Physical properties: fw=70.0908 g/mole, fp=-81° C, bp=69° C
- Supplier and stated purity: Aldrich, 95%
- Sample class: I (PNNL scale).
- Temperature of sample: 25.03 ± 0.02 C
- Diluent: Sample back 1.03850, 2.1840, 3.0833, 0.63033, 1.6666, 33.93, 16.32, 8.1250, 4.4788 and 64.65 filled with ultra high purity nitrogen to 760 ± 5 Torr
- Individual samples at Torr. Path length = 19.96 cm. Final data is a composite spectrum.
- Preparation: Multiple freeze-thaw cycles at 0 C to remove air.

Instrument Parameters-

- Bruker-66V FTIR, temperature controlled environment, evacuated optics bench
- Modified to include second aperture, between interferometer output and sample cell. This substantially reduces both “ghosting” and warm aperture effects.
- Spectral range: 6,500 to 600 cm^{-1} (1.534 to 16.667 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 ($\alpha=0.85$, $\epsilon=530$)
- Composite spectrum created from 10 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 = 0.32%, Type B $\leq 3\%$
- Frequency correction (already applied): $V(\text{corrected}) = V(\text{instrument}) * 0.99999896 + 8.812 \times 10^{-4}$
- Axis units: X=wavenumbers (cm^{-1}), Y=Absorbance (base-10)
- Trace carbon dioxide features removed via spectral subtraction

- Baseline correction via 7th order polynomial subtraction