

All data taken at Pacific Northwest National Laboratory (PNNL)

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Composite spectrum for ISOVAL\_5T

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

Equivalent concentration x path-length of composite spectrum:  $3.5461 \times 10^{-6}$  grams/liter-meter

### Sample Conditions-

- Chemical name and CAS number: Isovaleraldehyde;  $\beta$ -Methylbutanal; Isopentanal; Isovaleral; Isovaleric aldehyde; Isovalerylaldehyde; 3-Methylbutan-1-al; 3-Methylbutanal; 3-Methylbutyraldehyde; iso-C<sub>4</sub>H<sub>9</sub>CHO; Butyraldehyde, 3-methyl-; Isoamylaldehyde; Isopentaldehyde; 1-Butanal, 3-methyl-; 2-Methylbutanal-4; 3-Methyl-1-butanal C<sub>5</sub>H<sub>10</sub>O: [590-86-3]
- Physical properties: MW=86.1323 g/mole, mp= -51 C, bp=92.2° C, Density (25 C) = 0.803 g/cm<sup>3</sup>
- Supplier and stated purity: Aldrich 97 %
- Sample class: I (PNNL scale).
- Temperature of sample: 5.00  $\pm$  0.02 C
- Diluent: Sample back filled with ultra high purity nitrogen to 760  $\pm$  5 Torr.
- Individual samples at 1.09200, 2.1020, 4.0700, 8.5900, 10.1600 and 6.1300 Torr. Path length= 19.96 cm. Final data is a composite spectrum.
- Preparation: Multiple freeze-thaw cycles at 77K to remove air.

### Instrument Parameters-

- Bruker-66V FTIR, 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 500 cm<sup>-1</sup> (1.538 to 20.00 microns)
- Instrumental resolution based on maximum interferometer displacement is 0.112 cm<sup>-1</sup>
- Spectral interval after 2X zero-filling interferogram and FFT: 0.06 cm<sup>-1</sup>
- 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<sup>-1</sup>

### Post Processing and Related Parameters-

- Non-linearity detector correction (Bruker proprietary) applied to interferogram ( $\alpha=0.90$ ,  $\epsilon=500$ )
- Composite spectrum created from 6 individual absorbance (base-10) spectra via classical least squares fit: Intercept=0, slope is fitted, individual absorbance values weighted by T<sup>2</sup> (transmission squared), all absorbance values  $\geq 1.6$  are given zero weight
- Calculated and estimated errors: Type A =0.78%, Type B  $\leq$  3%

- Frequency correction (already applied):  $V(\text{corrected})=V(\text{instrument})\cdot 1.00000135+8.5741\times 10^{-4}$
- Axis units: X=wavenumbers ( $\text{cm}^{-1}$ ), Y=Absorbance (base-10)
- Trace carbon dioxide, water and a small unknown feature at  $3576 \text{ cm}^{-1}$  were removed by spectral subtraction
- Baseline correction via 7<sup>th</sup> order polynomial subtraction