

All data taken at Pacific Northwest National Laboratory (PNNL)

Operators: Steven W. Sharpe, Timothy J. Johnson and Robert L. Sams : [sw.sharpe@pnl.gov](mailto:sw.sharpe@pnl.gov)

Version 1.0, September, 05

Composite spectrum for STYROX\_50T

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

Equivalent concentration x path-length of composite spectrum:  $4.9467 \times 10^{-6}$  grams/liter-meter

### Sample Conditions-

- Chemical name and CAS number: Styrene oxide, 1,2-epoxyethylbenzene, 1-phenyl-1,2-epoxyethane, phenyloxirane, styrene epoxide, styryl oxide,  $C_6H_5C_2H_3O$  : [96-09-3]
- Physical properties: MW=120.1506 g/mole, mp=-36.8° C, bp=194.1° C, Density (20 C) 1.054 g/cm<sup>3</sup>
- Supplier and stated purity: Aldrich, 97%
- Sample class: I (PNNL scale).
- Temperature of White cell (796.0 cm optical path length)  $49.90 \pm 2$  C
- Diluent (high purity nitrogen) flowed at 24.2 liter/min (21.1° C), ambient atmospheric pressure  $760 \pm 5$  Torr.
- Samples flowed at 4.000, 1.000, 9.000, 15.000, 7.000, 5.000, 41.000, 8.000, 19.000, 3.000, 21.000, 10.000, 29.000 and 16.000 microliters/minute
- Individual samples at equivalent pressures of 0.026520, 0.006629, 0.059647, 0.099385, 0.046380, 0.033124, 0.271509, 0.052977, 0.125805, 0.019861, 0.139029, 0.066169, 0.191865 and 0.105843 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 510  $cm^{-1}$  (1.538 to 19.608 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 14 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  $\geq 1.6$  are given zero weight
- Calculated and estimated errors: Type A = 0.92%, Type B  $\leq 7\%$

- Frequency correction (already applied):  $V(\text{corrected})=V(\text{instrument})*0.99999959-3.45278 \times 10^{-4}$
- Axis units: X=wavenumbers ( $\text{cm}^{-1}$ ), Y=Absorbance (base-10)
- Trace water vapor and carbon dioxide features removed by spectral subtraction
- Baseline correction via 7<sup>th</sup> order polynomial subtraction