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Low temperature mid-infrared cross-sections for peroxyacetyl nitrate (PAN) vapour

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Abstract. Laboratory absorption spectra of peroxyacetyl nitrate (PAN, CH₃C(O)OONO₂) vapour have been measured in the mid-infrared range 550 cm⁻¹ to 1400 cm⁻¹ (18.2 to 7.14 μm) at both 250 K and 273 K, using a Fourier transform infrared spectrometer at a nominal spectral resolution of 0.25 cm⁻¹ (unapodised). In addition, the 1600 cm⁻¹ to 2200 cm⁻¹ (6.25 to 4.54 μm) spectral region has been measured at 250 K. Cross-sectional data at each temperature, as well as integrated band intensities and peak infrared absorptivities for nine absorption bands of PAN in this spectral range, have been derived from a total of twelve separately measured PAN transmission spectra. A general increase in the peak absorption cross-section for all bands is noted with decreasing temperature, with cross-sectional increases in the range 6% (for the 1842 cm⁻¹ band) and 30% (for the 991 cm⁻¹ band) at 250K, relative to those previously reported at 295K. Differences in integrated band intensities range from -22% to +16% for the 1741 cm⁻¹ and 991 cm⁻¹ bands respectively over the same temperature range. These new absorption cross-sections for PAN are the first to be reported at temperatures below 295 K, allowing the possibility of improved retrievals of the atmospherically important PAN species from remotely sensed infrared spectra of the cold upper troposphere. These new cross-sectional data accompany this paper as an electronic supplement.

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