

OBSERVATION OF TWO COMBINATION BANDS INVOLVING TORSION AND ASYMMETRIC BENDING MODES OF THE NON-POLAR N₂O DIMER

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The non-polar N₂O dimer has four low frequency intermolecular vibrational modes: van der Waals stretch (A_g symmetry), symmetric and asymmetric in-plane bends (A_g and B_u symmetry, respectively), and out-of-plane torsion (A_u symmetry). There are two possible intramolecular dimer vibrations which correlate with the ν_1 monomer stretch. One of these is an in-phase vibration of the two monomers, which has A_g symmetry and is not infrared active. The other is an out-of-phase vibration, which has B_u symmetry and gives rise to the infrared active dimer band at 2229.48 cm⁻¹. In the present work, we report the observation of an N₂O dimer band with c-type rotational structure, assigned as a combination of the A_g intramolecular N₂O ν_1 stretching vibration and the A_u intermolecular out-of-plane dimer torsional vibration. The vibrational origin for this band is measured to be 2249.360 cm⁻¹, giving an estimated torsional frequency of 21.5 cm⁻¹. A second combination band with a- and b-type rotational transitions has also been measured and assigned as the combination of the same A_g intramolecular vibration and the B_u asymmetric van der Waals bend. The measured band center is 2264.37 cm⁻¹, giving an asymmetric bending frequency of about 36.5 cm⁻¹. A search for the other two combination bands is currently underway.