NEW INFRARED SPECTRA OF THE NITROUS OXIDE TRIMER

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Infrared spectra of N_2O trimers are studied using a tunable diode laser to probe a pulsed supersonic slit-jet expansion. A previous observation by R.E. Miller and L. Pedersen [J. Chem. Phys. **108**, 436 (1998)] in the N_2O ν_1+ν_3 combination band region (3480 cm^{-1}) showed the trimer structure to be noncyclic, with three inequivalent N_2O monomer units which could be thought of as an N_2O dimer (slipped antiparallel configuration) plus a third monomer unit lying above the dimer plane. The present observations cover the N_2O fundamental band regions ν_3 (1280 cm^{-1}) and ν_1 (2230 cm^{-1}). In the ν_3 region, two trimer bands are assigned with vibrational shifts and other characteristics similar to those in the ν_1+ν_3 region, but in the ν_1 region all three possible trimer bands are observed. Relationships among the various bands such as rotational intensity patterns, vibrational shifts, and the properties of the related N_2O dimer, generally support the conclusions of Miller and Pedersen. Three trimer bands are also observed for the fully ^{15}N-substituted species in the ν_1 region, and these results should aid in detection of the as-yet-unobserved pure rotational microwave spectrum of the trimer. Finally, three combination bands involving the intermolecular van der Waals modes at 2253.7, 2255.5, and 2269.4 cm^{-1} have been measured. The analyses of these bands and the identification of the nature of the intermolecular modes involved are currently underway.