MICROWAVE SPECTRUM AND STRUCTURE OF A POLAR DIMER OF N_2O

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Cavity Fourier-Transform microwave spectroscopy has been used to characterise a gas phase, polar dimer of N_2O. The polar $(N_2O)_2$ unit is generated by co-expansion of a gas sample containing a small percentage of N_2O in a helium backing gas. Transitions in the pure rotational spectra of $(^{15}N_2O)_2$, $(^{14}N^{15}NO)(^{15}N_2O)$, $(^{14}N_2O)(^{15}N_2O)$ and $(^{14}N_2O)_2$ are reported. The measured transitions of $(^{15}N_2O)_2$ and $(^{14}N^{15}NO)(^{15}N_2O)$ are assigned and fitted to Hamiltonians allowing rotational, centrifugal distortion and ^{14}N nuclear quadrupole coupling constants to be determined. Hyperfine structure is assigned for a single $J'_{K'_{-1}K'_{+1}} \rightarrow J''_{K''_{-1}K''_{+1}}$ transition of both isotopomers of $(^{14}N_2O)(^{15}N_2O)$. Nuclear quadrupole coupling constants, χ_{bb}, are reported for all four ^{14}N nuclei. The measured χ_{bb} are in excellent agreement with those structures predicted from the measured rotational constants. The geometry of the molecule is slipped-parallel. The separation between the central nitrogen nuclei of the monomers in the $r_m^{(1)}$ structure is 3.570(12)Å with the two N_2O monomers respectively oriented 54.69(68)° and 49.85(64)° to the a-inertial axis. Simulation of hyperfine structure in the spectrum of the $(^{14}N_2O)_2$ isotopomer yields good qualitative agreement with experiment.