INFRARED SPECTRUM OF THE CO-NH_3 COMPLEX

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We have observed the IR spectrum of the weakly-bound complex CO-NH_3 in the C-O stretching region using a rapid scan diode laser spectrometer with a pulsed slit-jet supersonic expansion. A New Focus model 5612 astigmatic mirror system, mounted inside the vacuum chamber, gave 182 passes of the laser beam through the jet. With neon as the carrier gas, only weak CO-NH_3 signals could be observed; the best spectra were obtained using argon as the carrier (1 % NH_3, 9 % CO, 90 % Ar).

The only previous spectrum of CO-NH_3 was obtained in the microwave region using MBER.[a] It revealed a 'normal' $K = 0$ ground state series, two other almost-degenerate $K = 0$ excited state series, and two degenerate $K = 1$ excited series. The proposed structure had CO located close to the N atom in an undetermined orientation, with the NH_3 symmetry axis at an angle of about 36° relative to the intermolecular axis.

In the IR spectrum, we assign a 'normal' set of subbands with $K = 1 \leftarrow 0$, $0 \leftarrow 0$, and $0 \leftarrow 1$ for which the ground state ($v_{CO} = 0$) $K = 0$ levels are those of the 'normal' microwave series. The band origin lies only 0.11 cm^{-1} below that of the free CO molecule. The $K = 0$ to 1 energy interval is found to be 2.24 cm^{-1}; this value, and the fact that the parallel subband is weak, suggest that the CO is oriented roughly perpendicular to the intermolecular axis. The analysis indicates that an unassigned microwave line [1] at 14158 MHz is due to the 2_{11} - 1_{10} transition. The 'normal' subbands closely resemble those seen for CO-Ne or CO-Ar, and we believe that they are due to the lowest NH_3 internal rotation state of *A* symmetry. In addition to these 'normal' subbands, we also observe other series which are associated with the excited transitions observed in the microwave spectrum. These are likely due to internal rotation states of *E* symmetry.

[a] G.T. Fraser, D.D. Nelson, K.I. Peterson, and W. Klemperer, J. Chem. Phys. 84, 2472 (1986).