HIGH RESOLUTION INFRARED SPECTRA OF He_N-CO CLUSTERS IN THE RANGE N = 1 TO 20

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Infrared spectra of He_N-CO clusters with N up to about 20 have been observed in the 2145 cm^{-1}region of the C-O stretch using a tunable diode laser spectrometer and a high pressure ($\leq$ 40 atm) pulsed supersonic jet expansion from a cooled ($\geq$ -150 C) pinhole or slit nozzle. Compared to our recent work [1] on He_N-OCS clusters, the He_N-CO spectra are much "cleaner." They can therefore be followed to higher N-values, but contain less rotational information. Two series of $R(0)$ transitions were observed, each correlating smoothly with the known [2] a-type and b-type lines of the binary complex, He-CO. The b-type series starts off about 7 times stronger for N=1, but then loses intensity to the a-type series with increasing N. The cluster size numbering was reliably established up to N=14 for the a series and N=6 for the b series. Some "warmer" lines (e.g. $R(1)$) were observed and tentatively assigned, but these were not sufficient to enable rotational analysis. Thus it is not yet possible to separate the effects of vibrational shifts and rotational dynamics on the line positions. Two critical regions of cluster size were observed: around N=7 (where the b-type series disappears) and N=15 (where the a-type series fragments). These regions may be related to the calculated [3] maximum and minimum, respectively, in the incremental binding energy per added helium atom.

References

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