ROTATIONAL SPECTROSCOPIC STUDY OF SOLVATION OF HCCCN BY He-ATOMS

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The rotational spectra of He_N-HCCCN clusters (N = 2, 3, 4, 5) were measured in the 4-27 GHz range using a high-resolution Fourier transform microwave spectrometer. The weakly bound clusters were generated in a pulsed free jet expansion. Manipulating the sample and nozzle conditions allowed some degree of control over the successive solvation of the molecule with He-atoms. The presence of a ^{14}N nucleus in the clusters causes nuclear quadrupole hyperfine splitting of the He_N-HCCCN transitions. This hyperfine structure was resolved, assigned, and analysed for low-J transitions. Microwave-microwave double resonance experiments were used to enhance weak signals and to confirm the quantum number assignments. The value of the rotational constants decreases towards the helium nanodroplet value with increasing cluster size. Hyperfine fitting parameters and rotational constants will be interpreted in terms of the structure and dynamics of He_N-HCCCN clusters. There is the possibility to observe different behaviour of the He_N-HCCCN cluster properties at higher N values, compared to the relatively shorter OCS and N_2O analogues that have previously been studied in the microwave and infrared ranges.