INFRARED SPECTRA OF HYDROGEN - OCS CLUSTERS

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We have recently observed rich infrared spectra of helium clusters seeded with OCS, N_2O, or CO molecules. For He_N-OCS [1], transitions have been assigned up to N=8, for He_N-N_2O up to N=6, and for He_N-CO up to N=14. In all cases, lines due to even larger clusters are clearly present in the spectra but not yet definitively assigned. Using similar experimental conditions, we have also searched for analogous spectra using other clustering molecules such as hydrogen and neon. In the case of $(H_2)_N$-OCS clusters, we begin with a good knowledge of the binary complex, H_2-OCS [2]. It is then possible to identify likely candidates for transitions due to the clusters with N = 2, 3, and 4. One limitation is that we are not sure what kind of spectrum to expect for these clusters. In the case of H_2-OCS, the spectrum due to $ortho$-H_2 completely dominates when normal H_2 is used in the jet expansion, and it is difficult to observe the (somewhat different) spectrum due to the $para$ species even when using a $para$-enriched sample [2]. Since normal H_2 was used in the present cluster experiments, it is similarly likely that $ortho$-H_2 dominates, but we do not know what effect the angular momentum of each ground state $ortho$-H_2 will have on the cluster spectra, especially when coupling between these J=1 hydrogens is present for $N \geq 2$. To help to get around this problem, we have also recorded spectra of $(HD)_N$-OCS clusters, since in this case we can assume that the HD molecules will all relax to the J=0 ground state. We will present predictions of possible microwave transitions of hydrogen - OCS clusters, since such observations could provide positive confirmations of our assignments. Spectra showing Ne_N-CO transitions for N=2 and 3 will also be shown.

References

[1] J. Tang, Y. Xu, A.R.W. McKellar, and W. Jäger, *Science*, **297**, 2030 (2002).
[2] J. Tang and A.R.W. McKellar, *J. Chem. Phys.* **116**, 646 (2002).