LOW TEMPERATURE MATRIX ISOLATION, INFRARED SPECTRUM AND PHOTOLYSIS OF $BCl(N_3)_2$

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Infrared and UV absorption spectroscopy is being used with low temperature matrix isolation to probe the photolytic mechanism by which an interesting series of Group III-azide compounds decompose to form nitride films. These molecules can be synthesized in the gas phase at room temperature and decompose spontaneously or upon broad band UV irradiation without the requirement of excessive energy input from a laser, high heat or plasma discharge.[a] The simplicity of these systems makes them amenable to mechanistic studies of film formation, and one of the goals of this research is to identify the intermediates that form upon UV photolysis. The first series of compounds to be studied in our laboratory is the boron-azide containing molecules generated via the gas phase reaction between HN_3 with BCl_3. Three compounds can be formed, $BCl_2(N_3)$, $BCl(N_3)_2$, and $B(N_3)_3$, by adjusting the HN_3:BCl_3 ratio to 1:1, 1:2 and 1:3, respectively. Low temperature matrix isolation studies of the 1:1 and the 1:3 species have been completed and the results reported.[bc] In those studies, the photolytic intermediates were identified as the linear molecules NNBN (from $B(N_3)_3$) and ClBNCl (from BCl_2N_3). In this talk, the IR and UV absorption spectra obtained during the low temperature matrix isolation and photolysis of the 1:2 species, $BCl(N_3)_2$, will be presented and compared to the spectra obtained from the other molecules in the group. The spectra indicate the formation of two intermediates, one of which has been tentatively identified as a three-membered ring made up of two N atoms and a B atom, with a Cl atom attached to the B atom. The second intermediate, which has not been identified, displays features in the UV and the IR and is photolytically unstable.

[a] Mulinax, R. L.; Okin, G. S.; Coombe, R. D. J. Phys. Chem. 1995, 99, 6294.
[b] I. A Al-Jihad, B. Liu, C. J. Linnen, J. V. Gilbert, J. Phys. Chem., 1998, 102, 6220.
[c] L. A. Johnson, S. A. Sturgis, I. A. Al-Jihad, B. Liu, J. V. Gilbert, J. of Phys. Chem., 1999, accepted for publication.