ACTION SPECTROSCOPY AND DISSOCIATION ENERGY OF AMMONIA TRIMER

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We have investigated the energy dependence for the vibrational predissociation of ammonia trimer, $(NH_3)_3 \rightarrow (NH_3)_2 + NH_3$, using infrared-action spectroscopy. The action spectra come from detecting specific rovibrational states of the monomer fragment via (2+1) resonance enhanced multiphoton excitation (REMPI) while scanning the IR excitation laser over the NH stretch transitions of the trimer as well as the dimer. The relative intensities of the dimer and trimer features in the action spectra depend on the amount of energy available for breaking the hydrogen bonds in the clusters. For example, the action spectra of ammonia fragments with large amounts of internal energy (v_2=3) show almost no trimer contribution since there is not enough energy available to break two bonds in the cyclic trimer. The action spectra for fragments with low internal energies (v_2=1), on the other hand, exhibit a substantial trimer component as more energy remains available to dissociate the cluster. Using the threshold at which the trimer feature becomes apparent in our spectra as an upper limit ($E_{diss}^{max} = h\nu_{vib} - E_{int}(NH_3)$), we determine the dissociation energy of ammonia trimer to be in the range between 1700-1800 cm^{-1}. This range agrees well with theoretical predictions.