OBSERVATION OF NEW ELECTRONIC STATES OF THE Al-H_2/D_2 COMPLEX

XIAOFENG TAN, PAUL J DAGDIGIAN, *Department of Chemistry, The Johns Hopkins University, Baltimore, Maryland 21218-2685*.

A study of the electronic spectra of the weakly bound Al-H_2 and Al-D_2 complexes is presented. The complexes were generated in a pulsed, free-jet supersonic beam and detected with laser fluorescence excitation and depletion spectroscopy. All observed excited vibronic levels predissociate, and the transitions were detected by observation of lower-energy, emitting Al atoms. A long excited-state progression in the Al-H_2/D_2 stretch vibrational mode associated with the strongly bound $^2B_2$ electronic state correlating with the Al(3d) atomic asymptote was observed. The Lorentzian widths of these bands are large, indicative of strong coupling to the repulsive Al(4s)-H_2 state. A Franck-Condon analysis was carried out to derive an effective 1-dimensional potential energy curve for the van der Waals stretch coordinate in the excited $^2B_2$ state. This potential energy curve is compared with the previously computed 1-dimensional C_{2v} cut for this state[a]. Bands associated with the mixed 5d, 6s$\leftarrow$3p electronic transition are also reported. A complex of pattern of vibronic energies was observed, and the Lorentzian widths of these bands vary greatly. The binding energies of these and other Al-H_2 Rydberg states are compared with the computed binding energy of the ionic Al^+-H_2 complex.

---

[a] X. Tan, P. J. Dagdigian and M. H. Alexander, Faraday Discuss. 118 (2001) 387 .