Photodissociation Dynamics of Cluster Ions

Progress has been Made on the Following Two Objectives:

1) Photodissociation Dynamics of Small Cluster Ions
   (11 papers on 8 different clusters)

2) Generation, Structure and Reactivity of Metallic and Semiconductor Clusters
   (7 papers on various aspects)

A new technique for obtaining the structure of gas phase clusters was developed.
AFOSR Grant 89-0102

Photodissociation Dynamics of Cluster Ions
Final Report

November 15, 1988 to November 14, 1991

I. Abstract

There are two somewhat different objectives of this grant, unified by their common interest in clusters. We have made substantial progress both in photodissociation of atmospheric clusters (11 papers) and in the generation and reactivity of semiconductor and metallic clusters (7 papers). Of particular interest is our development of a new "ion chromatography" technique that allows determination of the shape of clusters, or other species, in the gas phase.

II. Objectives

A. Photodissociation Dynamics of Atmospheric Cluster Ions

B. Generation, Structures and Reactivity of Semiconductor and Metallic Cluster Ions

III. Progress

A. Photodissociation Dynamics of Cluster Ions

The progress made in this area has been described in detail in the two progress reports, the proposal funded as a one year extension to AFOSR 89-0102, and the proposal that recently was approved for funding commencing November 15, 1992. Consequently, only a list of the systems completed will be given here, with the associated papers tabulated in the publications section: Ar3+ (2 papers), CO3−, (C6H6)2+, (S*SO2)+, (Ar•N2)+, Kr•H2O+, CO3•H2O and (OCS•C2H2)+.

B. Carbon Clusters

Again, the work accomplished has been discussed in detail in the interim reports and proposals on file. The most important aspect of this work is the use of our recently developed "ion chromatography" technique for studying structures of carbon cluster ions.

C. Reactions of Transition Metal Cluster Ions

During the review period we were able to develop methods for generating intense beams of mass selected cluster ions up to M20+ for M = Nb, Co.
Preliminary reactions studies indicate this will be a fruitful area of research in the future.

IV. Papers published or in Press

1. Photodissociation Dynamics of \( \text{C}_4\text{H}_6^+ \) Ions from 1,3-Butadiene, T. Bunn and M.T. Bowers, *J. Phys. Chem.* 92, 1813 (1988).


13. Reply to the Comment on Evaporation of Covalent Clusters: Unimolecular


V. Personnel Associated with the Project

A. Senior

| Dr. Paul Kemper | Dr. Chou-Hong Kuo |
| Dr. Peter Radi | Dr. Joe Snodgrass |
| Dr. Susan Graul | Dr. Tom Bunn |
| Dr. Jennifer Brodbelt | Dr. Petra van Koppen |

B. Junior

| Ms. Hyun-Sook Kim | Ms. Coleen Roehl |
| Mr. Gert von Helden | Mr. Ming-Teh Hsu |
| Ms. Marina Rincon | Ms. Kathy Robbins |
| Ms. Sherrie Walsh |

VI. Papers Presented at Meetings/Universities

A. Invited Lectures

1. Award Lecture, Nobel Laureate Signature Award Symposium, 198th National Meeting of the American Chemical Society, Miami, FL, September 1989.

3. Invited Speaker, Gordon Research Conference on Molecular and Ionic Clusters, Volterra, Italy, September 1990 (Photodissociation Dynamics of Small Cluster Ions).

4. Invited Speaker, 8th Asilomar Conference on Reaction Intermediates, Pacific Grove, CA, September 1990 (Ion Chromatography and Metallic Clusters).


8. Invited Lecturer, Franklin and Field Award Symposium, 199th National American Chemical Society Meeting, Atlanta, GA, April 1991 (Carbon Clusters).


B. Contributed Papers at Conferences (Topics not given for sake of brevity)


8. Presented three papers, 12th International Conference on Mass

C. **Invited Seminars at Universities**
1. Iowa State University, Ames, IA, February 1989.
4. University of Texas, Austin, TX, October 1990.
5. Rice University, Houston, TX, October 1990.
6. University of Southern California, Los Angeles, CA, November 1990
8. University of Sussex, Brighton, United Kingdom, September 1991
9. University of Warwick, Coventry, United Kingdom, September 1991
10. Texas A&M University, College Station, TX, October 1991