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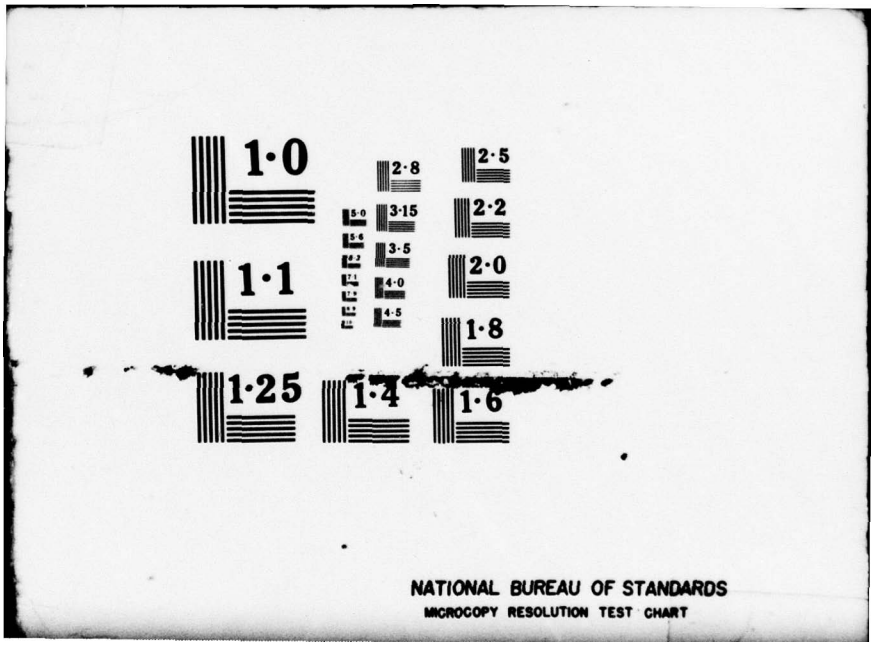
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PROJECT SQUID

TECHNICAL REPORT MIT-89-PU

EXPERIMENTAL AND THEORETICAL STUDIES OF CHEMICAL DYNAMICS AND INSTABILITIES IN IRREVERSIBLE PROCESSES

by

JOHN ROSS AND F. G. KEYES
CHEMISTRY DEPARTMENT
MASSACHUSETTS INSTITUTE OF TECHNOLOGY
CAMBRIDGE, MASSACHUSETTS 02139

PROJECT SQUID HEADQUARTERS
CHAFFEE HALL
PURDUE UNIVERSITY
WEST LAFAYETTE, INDIANA 47907

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The final report summarizes the work accomplished under the subcontract. The overall objectives of the investigation were as follows: The determination of molecular properties of chemical dynamics for reactions of importance to combustion and propulsion. Molecular beam techniques were used for the experimental part of this work and were accompanied by theoretical studies in chemical dynamics. The second purpose was the study of the interaction of chemical reactions with transport processes and flows in gases in which instabilities may occur.

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AS RELATED TO JET PROPULSION
OFFICE OF NAVAL RESEARCH, DEPARTMENT OF THE NAVY

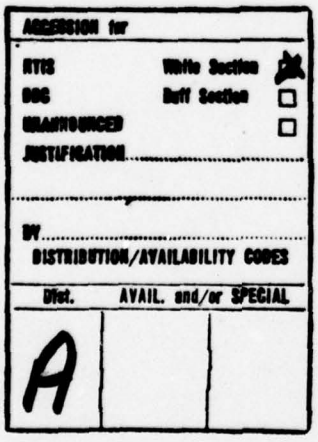
CONTRACT N00014-75-C-1143 NR-098-038

EXPERIMENTAL AND THEORETICAL STUDIES OF CHEMICAL DYNAMICS AND INSTABILITIES IN IRREVERSIBLE PROCESSES

by

John Ross and F. G. Keyes
Chemistry Department
Massachusetts Institute of Technology
Cambridge, Massachusetts 02139

May 1978



Project SQUID Headquarters
Chaffee Hall
Purdue University
West Lafayette, Indiana

ABSTRACT

The final report summarizes the work accomplished under the subcontract. The overall objectives of the investigation were as follows: The determination of molecular properties of chemical dynamics for reactions of importance to combustion and propulsion. Molecular beam techniques were used for the experimental part of this work and were accompanied by theoretical studies in chemical dynamics. The second purpose was the study of the interaction of chemical reactions with transport processes and flows in gases in which instabilities may occur.

PROJECT SQUID FINAL REPORT

A. Identification

Principal Investigator: John Ross, F. G. Keyes Professor of Chemistry

Contractor: Massachusetts Institute of Technology

Contract No.: Sub 4965-10 under Contract N00014-67-0226-0005

Title: Experimental and Theoretical Studies of Chemical Dynamics and Instabilities in Irreversible Processes

B. Duration:

October 1, 1967 - December 31, 1977

C. Participation

Other Support: Work has been supported in part by the National Science Foundation (30%) and M.I.T. (20%).

Names of Investigators who contributed to research:

† Robert K. Brown
* Randolph H. Burton
Rashmikant C. Desai
* Michele Flicker
George P. Flynn
* John A. Gracki
Hong-sup Hahn
Raymond Kapral
* Jennifer Makowski
* David L. McFadden
Charles Mims
Abraham Nitzan
Peter Ortoleva
* Lawrence G. Piper
Itamar Procaccia
George Schatz

† M. A.

* Ph. D.

D. Object

Purpose of Research: The determination of molecular properties of chemical dynamics for reactions of importance to combustion and propulsion. Molecular beam techniques were used for the experimental part of this work and were accompanied by theoretical studies in chemical dynamics. The second purpose was the study of the interaction of chemical reactions with transport processes and flows in gases in which instabilities may occur.

E. Achievement

Extensive progress has been made in the study of chemical dynamics both experimentally and theoretically. We developed simple but effective methods of estimating reaction cross sections which include the details of rotational and vibrational distribution of the energy of reaction in the reaction products.

The study of chemical instabilities proceeded along both theoretical and experimental lines. We demonstrated the theoretical feasibility of a large number of new phenomena such as light-induced spatial structures, chemical oscillations, and multiple stationary states. On the enclosed publication list, research sponsored in part by Project SQUID is marked with an asterisk.

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