

AD-A201 612

DTIC FILE COPY

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

(2)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER <i>ARO 22792.14-PH-H</i>	2. GOVT ACCESSION NO. N/A	3. RECIPIENT'S CATALOG NUMBER N/A
4. TITLE (and Subtitle) Kinetic Processes in Discharge Pumped Mercury Halide Lasers		5. TYPE OF REPORT & PERIOD COVERED Final, May 85 - July 1988
		6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) Vikram S. Kushawaha		8. CONTRACT OR GRANT NUMBER(s) DAAG29-85-G-0081
9. PERFORMING ORGANIZATION NAME AND ADDRESS Howard University 2400 Sixth St., N.W. D.C. 20059		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS U. S. Army Research Office Post Office Box 12211 Research Triangle Park NC 27709		12. REPORT DATE 8-15-1988
		13. NUMBER OF PAGES 3
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)		15. SECURITY CLASS. (of this report) Unclassified
		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE
16. DISTRIBUTION STATEMENT (of this Report) Approved for public release; distribution unlimited.		
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report) NA		
18. SUPPLEMENTARY NOTES The view, opinions, and/or findings contained in this report are those of the author(s) and should not be construed as an official Department of the Army position, policy, or decision, unless so designated by other documentation.		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) Electron ^e ion collisions, HgX_2 and CH_3HgX ($X = Cl, Br, I$) Molecules, Emission cross sections, Kinetic energies, Mercury Halide lasers. (mgm)		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) → This report describes the formation of excited state species observed during collisions involving HgX_2 / CH_3HgX ($X = C, Br, I$) molecules and electrons or ions at different laboratory kinetic energies. Electron impact dissociation of HgX_2 and CH_3HgX has been studied and formation of HgX (n^2P)-radicals and highly excited state of		

DTIC
ELECTE
OCT 20 1988
S
D

20. ABSTRACT CONTINUED

← Keywork: Hg atoms has been observed in the laboratory kinetic energy range of 1–100 eV. With electron and CH_3HgX collisions, emissions from CH-radicals and atomic hydrogen have also been observed, in addition to the above mentioned species. Emission cross sections of the HgX ($B^2\Sigma, v' = 0 \rightarrow X^2\Sigma, v'' = 22$) in the laboratory kinetic energy range of 1 – 100 eV have been measured. Similar results were obtained when the electrons were replaced by ions such as N^+ , N_2^+ , CO^+ , CO_2^+ , O^+ , Ar^+ , Ar_2^+ , He^+ and He_2^+ . Emission cross sections of the HgX ($B^2\Sigma, v' = 0 \rightarrow X^2\Sigma, v = 22$) radicals and of mercury atomic lines during transitions from levels as high as $\text{Hg}(7^3S_1)$ to various lower levels have been measured in the laboratory kinetic energy range of 1 – 1000 eV of the projectile ions.

Collisional studies involving some metastable molecules such as $\text{N}_2(\text{A})$ and $\text{HgX}_2/\text{CH}_3\text{HgX}$ ($\text{X} = \text{Cl}, \text{Br}, \text{I}$) molecules have also been studied. The $\text{N}_2(\text{A})$ metastable molecules were generated by passing microwave discharge through NaN_3 vapors. Intense emissions from the HgX ($B^2\Sigma - X^2\Sigma$)–radicals were observed during collisions of $\text{N}_2(\text{A})$ and $\text{HgX}_2/\text{CH}_3\text{HgX}$ vapors. The relative rate of HgX ($B^2\Sigma, v' = 0 \rightarrow X^2\Sigma, v'' = 22$) formation with HgX_2 was determined to be $K_1 : K_2 : K_3 :: 1 : 6.4 : 8.6$ and with CH_3HgX vapors, $K_1 : K_2 : K_3 :: 1 : 4.8 : 7.7$ respectively.

These results have either been published or submitted for publication in scientific journals. A list of publications through grant no. DAAG-29-85-G-0081 is attached here.

21. SCIENTIFIC PERSONNEL SUPPORTED BY THIS PROJECT AND DEGREES AWARDED DURING MAY 85 – JULY 1988 PERIOD:

- (1). M. Mahmood
- (2). William Hercules
- (3). A. Michale
- (4). Aaron White

Degrees awarded: One Ph.D. Degree

88 10 19 068

LIST OF PUBLICATIONS THROUGH GRANT NO. DAAG-29-85-G-0081

1. Dissociative Excitation of HgX -radicals and Hg -atoms During Collisions of CO^+ and HgX_2 and CH_3HgX ($\text{X}=\text{Cl}, \text{Br}, \text{I}$) Molecules.
V. Kushawaha and A. Michael, Chem. Phys. (submitted)
2. Chemiluminescent Studies involving Collisions of $\text{He}^+/\text{He}_2^+$ Ions and HgBr_2 .
V. Kushawaha and A. Michael, J. Chem. Phys. (submitted)
3. Relative efficiency of $\text{HgBr}(\text{B-X})$ Formation due to Collisions of CO^+/N_2^+ ions and HgBr_2 .
V. Kushawaha and A. Michael, Chem. Phys. Lett. (accepted)
4. Discharge Properties of NaN_3 Relevant to HgBr laser
V. Kushawaha and A. Michael, JQSRT (accepted)
5. $\text{HgBr}(\text{B-X})$ Formation due to $\text{Ar}^+/\text{Ar}_2^+$ and HgBr_2 Collisions.
V. Kushawaha and A. Michael, JQSRT (In Press)
6. Collision Induced Dissociative Processes Relevant to Mercury Halide Lasers.
V. Kushawaha, A. Michael and M. Mahmood, J. Phys. B (In Press)
7. Collisional Studies Involving N^+ and N_2^+ ions and HgX_2 ($\text{X}=\text{Cl}, \text{Br}, \text{I}$).
V. Kushawaha, A. Michael and M. Mahmood, Phys. Rev. A (In Press)
8. Observation of Excited State Species Due to N^+/N_2^+ and CH_3HgX ($\text{X}=\text{Cl}, \text{Br}, \text{I}$) Collisions.
V. Kushawaha, A. Michael and M. Mahmood, Chem. Phys. 122, 182, 1988.
9. On the Multiline Operation of Mercury halide Lasers,
V. Kushawaha, A. Michael and M. Mahmood, Spectry. Lett. 21, 63, 1988.
10. Formation of $\text{HgX}(\text{B-X})$ Due to $\text{HgX}_2/\text{CH}_3\text{HgX}$ ($\text{X}=\text{Cl}, \text{Br}, \text{I}$) and $\text{N}_2(\text{A})$ Collisions.
V. Kushawaha, A. Michael and M. Mahmood, Spectry. Lett. 21, 157, 1988.
11. Collisional Studies Involving Electron and Mercury Compound.
V. Kushawaha and M. Mahmood, J. Opt. Soc. Am. A4, p37, 1987.
12. Electronic Excitation of HgX ($\text{X}=\text{Cl}, \text{Br}, \text{I}$) Due to Electron and Methyl Mercury Halide Collisions.
V. Kushawaha and M. Mahmood, JQSRT 38, 267, 1987.
13. Electron Impact Excitation of HgX_2 ($\text{X}=\text{Cl}, \text{Br}, \text{I}$)
V. Kushawaha and M. Mahmood, J. Appl. Phys. 62, 2173, 1987.



☒
☐
☐

A-1