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GEORGIA INSTITUTE OF TECHNOLOGY  
OFFICE OF CONTRACT ADMINISTRATION  
SPONSORED PROJECT INITIATION

Date: 5/25/79

Project Title: "Investigation of the Capture of Sulfur Dioxide and Oxygen by  
Condensation of Water in Droplets, Fogs and Aerosols"

Project No: E-19-683 *Greenland*

Project Director: Dr. M. J. Matteson

Sponsor: U. S. Department of Energy

Agreement Period: From 3/1/79 Until 2/28/80 (02 yr.)

Type Agreement: Contract No. DE-AS05-77EV05592; Mod. # M001, (formerly EE-77-S-05-5592)

Amount: \$38,729 (02 yr. only) *E-19-656*

Reports Required: Progress Report, Final Report

Sponsor Contact Person (s):

Technical Matters

Robert W. Beadle  
Pollutant Characterization and  
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Research  
Department of Energy  
Washington, D.C. 20545

Contractual Matters

(thru OCA)

A. H. Frost, Jr., Chief  
Contract Management Branch  
Procurement & Contracts Branch  
U.S. Department of Energy  
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Oak Ridge, Tennessee 37830

Defense Priority Rating: N/A

Assigned to: Chemical Engineering (School/Laboratory)

COPIES TO:

Project Director  
Division Chief (EES)  
School/Laboratory Director  
Dean/Director—EES  
Accounting Office  
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Project File (OCA)  
Project Code (GTRI)  
Other \_\_\_\_\_

SPONSORED PROJECT TERMINATION SHEET

Date 2/4/82

Project Title: Investigation of the Capture of Sulfur Dioxide ----

Project No: E-19-683

Project Director: Dr. M. J. Matteson

Sponsor: U. S. Department of Energy

Effective Termination Date: 2/28/80

Clearance of Accounting Charges: \_\_\_\_\_

Grant/Contract Closeout Actions Remaining:

- ~~Final Invoice~~ and Closing Documents
- Final Fiscal Report (Final Progress Report accepted in lieu of)
- Final Report of Inventions (obtaining from Project Director)
- Govt. Property Inventory & Related Certificate
- Classified Material Certificate
- Other \_\_\_\_\_

Assigned to: Chemical Engineering (School/Laboratory)

COPIES TO:

Administrative Coordinator	Research Security Services	EES Public Relations (2)
Research Property Management	Reports Coordinator (OCA) ✓	Computer Input
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Procurement/EES Supply Services	Library	Other _____

INVESTIGATION OF THE CAPTURE OF  
SULFUR DIOXIDE AND OXYGEN BY  
CONDENSATION OF WATER IN DROPLETS

Progress Report

Michael J. Matteson

Georgia Institute of Technology  
Atlanta, Georgia

March 1, 1979 - November 30, 1979

PREPARED FOR THE U.S. DEPARTMENT OF ENERGY

UNDER CONTRACT NO. DE-AS05-77EVO5592

(formerly EE-77-S-05-5592)

Part I: Description of Experimental Work and Results during Period

3/1/79 - 11/30/79

In the second phase of this research program, we have begun the investigation of the capture of  $\text{SO}_2$  by growing aerosols. An aerosol generation and collection system has been constructed and initial testing of the collector completed.

The aerosol generation system consists of a LaMer - Sinclair type double furnace wherein bulk sodium chloride is vaporized, condensed, re-vaporized and condensed as monodisperse submicron spherical particles of uniform size distribution. These particles are sampled electrostatically on an electron microscope grid, photographed, and then sized with a Zeiss TGZ-3 counter-sizer.

The quantity of water vapor condensed on the salt nuclei can be varied by regulating the amount of water vapor introduced. Final droplet sizes are sampled and measured by collecting wet aerosol in an Anderson Cascade Impactor with preweighed glass fiber collection discs on each stage. The discs are dried and the salt residue determined from a second weighing, yielding a size distribution according to particle mass.

In the main absorption train, the dry NaCl particles are exposed to a humidified nitrogen stream containing a controlled (1000 - 3000 ppm) amount of  $\text{SO}_2$ . The grown droplets containing  $\text{SO}_2$  are then separated from the gas stream electrostatically. This is done to separate the droplets containing absorbed  $\text{SO}_2$  from the  $\text{SO}_2$  in the carrier stream in order to avoid continued absorption of  $\text{SO}_2$  by the droplets after capture has taken place. A point-to-plane assembly was constructed which consisted of a charged steel needle perpendicular to the flow direction and with the tip at the axis of flow. The grounded plane consists of a platinum grid, 3 cm in diameter, immersed

0.5 cm below a solution of pararosaniline chloride. A sheath of SO<sub>2</sub>-free, humidified nitrogen passes in an annular stream between the main stream and the collector. The SO<sub>2</sub> in the collected droplets is then determined by UV spectrophotometry with the sampling solution.

A source of error in the above described collection system is the unintentional collection of gaseous SO<sub>2</sub> ions or the attachment of gaseous SO<sub>2</sub> to ionized water vapor generated in the corona. Ionized H<sub>2</sub>O or SO<sub>2</sub> may serve as condensation nuclei and these droplets may be confused with the controlled-growth NaCl nucleated droplets.

Preliminary tests to determine the extent of corona-generated deposition of SO<sub>2</sub> have been made and results appear in the attached figure. The potential was varied between 8 - 15 kV, the upper limit determined by spark-over. Current flow as well as SO<sub>2</sub> collected was measured over this range of potential for the cases of dry and saturated nitrogen carrier stream. Results indicate significant corona-generated deposition of SO<sub>2</sub> in both the dry and wet streams. A maximum deposition of SO<sub>2</sub> is reached at a current of about 0.2 mA, and the deposition from the humid stream is about 50 percent greater than that from the dry stream. These results must be taken into account in further testing with controlled-growth NaCl aerosols.

Part II: Presentations during Period 3/1/79 - 11/30/79

ORO-5592-3 (attached)

"Mass Transfer of Gases to Growing Water Droplets", presented at the Twelfth Rochester International Conference on Environmental Toxicity, School of Medicine and Dentistry, University of Rochester, Rochester, N.Y., May 21-23, 1979, with W. W. Flack.

ORO-5592-4 (attached)

"Enhanced Mass Transfer During Droplet Growth", presented to the 87th National Meeting, AIChE, Boston, Mass., August 19-22, 1979, with W. W. Flack and A. A. Liabastre.

Part III: Effort expended by Principal Investigator

Period March 1, 1979 - November 30, 1979

25% time

Period December 1, 1979 - February 29, 1980

25% time

Corona Generated SO<sub>2</sub> Deposition  
from Nitrogen + 1000 ppm SO<sub>2</sub>

