

GEORGIA INSTITUTE OF TECHNOLOGY  
OFFICE OF CONTRACT ADMINISTRATION  
SPONSORED PROJECT INITIATION

Date: 9/27/79

Project Title: Diffusion in Supersaturated Solutions

Project No: E-19-601

Project Director: Dr. Allan S. Myerson

Sponsor: American Chemical Society, The Petroleum Research Fund; Washington, D.C. 20036

Agreement Period: From 9/1/79 Until 8/31/81

Type Agreement: Grant No. PRF 11178-GB

Amount: \$10,000

Reports Required: Annual Financial Statement of Expenditures; Annual Progress Report

Sponsor Contact Person (s):

Technical Matters

Contractual Matters  
(thru OCA)

Mr. Justin W. Collat  
Program Administrator  
The Petroleum Research Fund  
American Chemical Society  
1155 Sixteenth Street, N.W.  
Washington, D. C. 20036  
(202) 872-4481

Defense Priority Rating: None

Assigned to: Chemical Engineering (School/Laboratory)

COPIES TO:

Project Director  
Division Chief (EES)  
School/Laboratory Director  
Dean/Director-EES  
Accounting Office  
Procurement Office  
Security Coordinator (OCA)  
☒ Reports Coordinator (OCA)

Library, Technical Reports Section  
EES Information Office  
EES Reports & Procedures  
Project File (OCA)  
Project Code (GTRI)  
Other OCA Research Property Coordinator

SPONSORED PROJECT TERMINATION SHEETDate 9/28/81

Project Title: Diffusion in Supersaturated Solutions

Project No: E-19-601

Project Director: Dr. Allan S. Myerson

Sponsor: American Chemical Society, The Petroleum Research Fund; Washington

Effective Termination Date: 8/31/81Clearance of Accounting Charges: 8/31/81

Grant/Contract Closeout Actions Remaining:

- ☐ Final Invoice and Closing Documents
- ☒ Final Fiscal Report
- ☐ Final Report of Inventions
- ☐ Govt. Property Inventory & Related Certificate
- ☐ Classified Material Certificate
- ☐ Other \_\_\_\_\_

Assigned to: Chemical Engineering (School/Laboratory)COPIES TO:

Administrative Coordinator  
Research Property Management  
Accounting  
Procurement/EES Supply Services

Research Security Services  
~~Reports Coordinator (OCA)~~  
Legal Services (OCA)  
Library

EES Public Relations (2)  
Computer Input  
Project File  
Other \_\_\_\_\_

THE PETROLEUM RESEARCH FUND

11178-GB Diffusion in Supersaturated  
Solutions

REPORT ON ACTIVITY ASSISTED BY

GRANT, PRF # 11178-GB

Allan S. Myerson, Georgia Institute of  
Technology

Page 1 of      pages.

PREPARED BY

Dr. Allan S. Myerson

Date September 17, 1980

Please refer to instructions.

Fill in information requested  
above for each page.

The report heading, narrative,  
and all drawings must be prepared  
within the box.

Please submit one sharp, clear  
"original" and a copy (Xerox,  
carbon, etc.) for each page.

Diffusion plays a crucial role in a variety of industrial operations including adsorption, extraction, heterogeneous reaction and crystallization. In practical industrial crystallization processes the rate of crystal growth is controlled by a combination of diffusion and kinetic processes. In the analysis of mass transfer during crystal growth the diffusion of solute in the solution must play an important role. Concentration dependent diffusion in supersaturated solutions, however, has never been systematically studied.

In this project the diffusion coefficients of a variety of compounds in supersaturated solutions are being measured employing a Gouy interferometer. The Gouy interferometer constructed employs a Helium-Neon laser as a light source to illuminate the horizontal source slit which is focused by means of a lens on to a specially constructed real image camera. Currently systems of non-electrolytes in aqueous solution are being studied. Results will be compared with the predictions of existing correlations for concentration dependent diffusion of non-electrolytes. During the next year electrolytic solutions will also be studied. It will also be attempted to devise a new correlation based on the concentration of molecular aggregates calculated from two dimensional nucleation growth theories.

PRF# 11178-GB REPORTING PERIOD 9/1/79 TO 8/31/80

GRANTEE INSTITUTION Georgia Institute of Technology DEPARTMENT Chemical Engineering

PRINCIPAL INVESTIGATOR(S) Allan S. Myerson

GRANT PROJECT TITLE Diffusion in Supersaturated Solutions

List undergraduate, graduate, and postdoctoral co-workers receiving stipends under the above named grant:

NAME	TITLE OR ACADEMIC APPOINTMENT	PREVIOUS EDUCATION & DEGREES*	COUNTRY OF PERMANENT RESIDENCE	PERIOD OF SUPPORT (MONTHS)	PERCENT OF SUPPORT FROM PRF **	DEGREES RECEIVED (IF ANY) DURING REPORTING PERIOD
None						

List other co-workers on grant project not directly supported with ACS - PRF funds:

NAME	SOURCE OF SUPPORT	DATES ASSOCIATED WITH GRANT PROJECT
Louis Sorrell	Georgia Institute of Technology	9/1/79 - present (M.S. student)

\* For graduate students, indicate the College or University attended prior to graduate work. For postdoctoral fellows, give the name of the Ph. D. granting institution.

\*\* (average for period indicated in preceding column)

Revised 7/80

E-17-601

GEORGIA INSTITUTE OF TECHNOLOGY  
ATLANTA, GEORGIA 30332

OFFICE OF  
THE  
COMPTROLLER

October 31, 1980

The Petroleum Research Fund  
American Chemical Society  
1155 Sixteenth Street, N.W.  
Washington, D.C. 20036

Gentlemen:

Enclosed in duplicate is the Annual Financial Statement for PRF No. 10602-G7 from the grant covering the period September 1, 1979 through August 31, 1980.

If you have questions or desire any additional information, please let us know.

Sincerely,

David V. Welch, Manager  
Grants and Contracts Accounting

DVW/SS/jb  
Enclosures

cc: Dr. A. S. Myerson  
Dr. G. W. Poehlein  
Mr. H. G. Dean, Jr.  
Mr. O. H. Rodgers  
File E-19-601

11/7/80

ANNUAL FINANCIAL STATEMENT  
(Insert "Annual" or "Final", as appropriate)

**AMERICAN CHEMICAL SOCIETY - THE PETROLEUM RESEARCH FUND**

For the Period: 9/1/79 to 8/31/80  
(August 31 is the preferred closing date for the reporting period)

Balance Carried Over from Previous Reporting Period (from Same or Earlier Grant)	\$	.00
Received from PRF During Reporting Period		.00
Salaries to:		
Principal Investigator		.00
(Contribution Toward Summer Salary*)		.00
Graduate or Undergraduate Students		.00
Postdoctoral Fellows		.00
Fellowships or Scholarships to:		
Undergraduate Scholars		.00
Graduate Fellows		.00
Postdoctoral Fellows		.00
Tuition		.00
Materials and Supplies		708.55
Equipment		8,999.14
Computer Time Charges		.00
Travel		.00
Other Expenses		139.40
Departmental Supplement or Allocation*		.00
* If provided in grant agreement		
Total Expenditures During Reporting Period		\$ 9,847.09
Balance on Hand at End of Period	\$	152.91
Total of PRF Grant Payments Received to Date		\$ 10,000.00

Complete this section only for a FINANCIAL STATEMENT which shows a balance in the grant account at the termination date of the current grant agreement.

The balance in the grant account will be liquidated

☐ By refund of unspent and uncommitted funds. The check should be drawn to the order of American Chemical Society - The Petroleum Research Fund, and identified by the number of the grant.

☐ By use in the completion of the grant project. We hereby request approval by the American Chemical Society of an extension of the grant agreement, without commitment of additional funds until \_\_\_\_\_, (Period up to one year, renewable - insert "Annual" above).

We certify that the expenses reported herein were incurred for education and research in accord with the terms of the approved ACS-PRF grant-in-aid.

Georgia Institute of Technology

(Grantee Institution)

By <u>David V. Welch, Mgr.</u>	10/31/80
(Financial Officer)	(Date)
A. S. Myerson	11178-GB
(Name of Principal Investigator)	(PRF No.)

\*\* Please submit IN DUPLICATE to The Petroleum Research Fund,  
American Chemical Society, 1155 Sixteenth Street, N. W.  
Washington, D. C. 20036 \*\*

GEORGIA INSTITUTE OF TECHNOLOGY  
ATLANTA, GEORGIA 30332

SCHOOL OF  
CHEMICAL ENGINEERING

September 14, 1981

Dr. Justin W. Collat  
Program Administrator  
The Petroleum Research Fund  
1155 Sixteenth St. N.W.  
Washington DC 20036

Dear Dr. Collat:

Enclosed are a final annual report and personnel  
statement for PRF Grant #1178-GB.

Sincerely,

Allan S. Myerson  
Assistant Professor

Encl.

ASM/11c

REPORT ON ACTIVITY ASSISTED BY  
GRANT, PRF # 1178-GB

Page 1 of 1 pages.

PREPARED BY

Allan S. Myerson

Assistant Professor

Date \_\_\_\_\_

Please refer to instructions.

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and all drawings must be prepared  
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carbon, etc.) for each page.

1178-GB Diffusion in Supersaturated  
Solutions

Allan S. Myerson, Georgia Institute of  
Technology

A relatively simple and extremely versatile optical method of obtaining diffusion coefficient data known as Gouy interferometry was employed to measure diffusion coefficients in undersaturated and supersaturated aqueous urea solutions at 25°C. The use of laser light as a monochromatic light source in the interferometer greatly simplified the procedure for obtaining diffusivity data from the interferometer. A novel design of a real image camera was employed to record the interferometric data. Values obtained from the interferometric data for low concentration (0-4 molar) aqueous urea solutions were within +5% of literature values.

The diffusion coefficient was found to decrease linearly with increasing concentration up to the saturation point of the aqueous urea solutions, and to decrease drastically with increasing concentration in the supersaturated region. It is speculated that this phenomenon is a result of molecular aggregation of the urea molecules in supersaturated aqueous solutions. Very little experimental data have previously been obtained in the supersaturated region due to crystallization problems. Supersaturated diffusion coefficient data are important in the study and design of crystallization processes.

The solid solute-liquid solvent binary systems urea-water and sucrose-water were modeled as a saturated solution solute-liquid solvent system in order to test various concentration-dependent diffusion relationships. Two of these relationships, the Vignes and Leffler-Cullinan equations, showed improved correlation with experimentally determined diffusivity data for aqueous urea and aqueous sucrose solutions at undersaturated conditions.