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Georgia Institute of Technology

A UNIT OF THE UNIVERSITY SYSTEM OF GEORGIA

ATLANTA, GEORGIA 30332

SCHOOL OF
CHEMICAL ENGINEERING
(404) 894-2807

April 12, 1982

Dr. R. Scott Pyron
Regional Director
Grants Program
Research Corporation
6075 Roswell Road, NE
Atlanta, GA 30328

Dear Dr. Pyron:

Enclosed is the final report on my research corporation grant. I would like to take this opportunity to thank the Research Corporation for its support.

Sincerely,

Allan S. Myerson
Assistant Professor

Enclosure

REPORT OF RESEARCH CORPORATION GRANT

(Submit original and one legible copy)

9120

Please check one)

Interim Report

Terminal Report

INSTITUTION AND ADDRESS

School of Chemical Engineering
Georgia Institute of Technology
Atlanta, GA 30332

PRINCIPAL INVESTIGATOR Allan S. Myerson

PHONE 404-894-2871

ACADEMIC RANK AND DEPARTMENT Assistant Professor Chemical Engineering

SHORT TITLE OF RESEARCH SUPPORTED BY GRANT

Concentration Dependent Diffusion Coefficients in Supersaturated Solutions

STARTING DATE March 1980

SUMMARY OR PRINCIPAL FINDINGS AND THEIR SIGNIFICANCE (State succinctly in language understandable to one not necessarily expert in this field. Include extent to which original goals have been realized and any changes to original plan made or contemplated.)

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 under saturated conditions.

REPORT OF RESEARCH CORPORATION GRANT

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STUDENT PARTICIPATION (Give names of students working on the project, their role in the research, their achievements and their career plans.)

Louis Sorrell, M.S. March 1981 - Constructed experimental apparatus. Studied the urea-water system.
Mr. Sorrell is currently employed at the Texaco Research Center in Beacon, N.Y..
Elizabeth Seely, M.S., expected January 1983. Ms. Seely will study the glycine-water system, other systems of nonelectrolytes and will be involved in theoretical predictions of diffusion coefficients.
Robert Ramsdell, B.S., June 1982. Mr. Ramsdell was involved in developing new techniques for the predicting of diffusion coefficients. Mr. Ramsdell will be attending graduate school.

PAPERS AND SCIENTIFIC TALKS (Give titles and references to papers or talks resulting from the work. Attach two copies of any reprints available, if not previously forwarded.)

"The Diffusivity of Urea in Supersaturated Solutions" In Press AIChE Journal.
"Concentration Dependent Diffusion in Supersaturated Solutions" presented at the National Meeting of the AIChE November 1981, New Orleans.

OTHER SUPPORT (List amounts and sources—including institutional—of other contributions received or expected for this work.)

Proposal "Concentration Dependent Diffusion Coefficients in Supersaturated Solutions" Submitted to the National Science Foundation.

EXPENDITURE OF RESEARCH CORPORATION GRANT FUNDS (The terminal report should be approved by an authorized officer of the institution.)

- a. Equipment, supplies (Itemize major expenditures) \$7,000
 - Temperature Control Equipment \$1500
 - Pumps \$1,000
 - Stereo Zoom Microscope \$1,000
 - Optical Components \$1,000

b. Stipends (Academic status, rates, periods of appointment)

c. Other expenditures (Itemize and give purpose)

Signature of principal investigator

Date

Signature of authorized officer of institution (required for terminal report only)

Date

Name and position of authorized officer of institution
Administrator Supervisor

4/13/82