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Statement of Work

The purpose of this program is to compile and initially evaluate diffusivity and viscosity data on gas, liquid, solid and turbulent flow systems. The program has been in operation for two and one half years. Progress in the various areas of the program is discussed separately in the following sections.

Binary Liquid Diffusivities

One of the principle accomplishments to date has been the completion of a computerized data logging system and with a provision for selective retrieval of data. Concurrently with the resolution of this data logging and retrieval system a complete program of review procedures has been worked out to permit the critical evaluation of molecular diffusion coefficients on a systematic basis. The efforts to date have centered exclusively on the molecular diffusion coefficient, however, it should be realized that the logging and retrieval system will work equally well for viscosity data.

The data logging and retrieval system may be characterized briefly by the following points: the solvent and solute names are codified to the system used by the Purdue Thermophysical Properties Review Center and the following data are logged for each system. (1) solute and solvent designation and name, (2) temperature, (3) solute concentration, (4) diffusion coefficient, (5) type of diffusion coefficient and method of measurement, (6) precision, (7) literature reference for the diffusion coefficient, (8) the viscosity value for the system, and (9) the reference for the viscosity value. The above are data values from the literature. An information printout precedes each Table to give directions for use. The retrieval system developed permits recall of any stored data on the basis of: solvent of solute name, temperature, the diffusion coefficient at infinite dilution, a particular type of diffusion coefficient or a particular experimental method, a particular literature reference, or finally reference by a given year. Thus, once the available experimental data is completely logged, we are in a position to retrieve data by solute, solvent, or systems and thus more effectively begin the process or critical evaluation and selection of most probable values. The "approved" values can then be logged and retrieved in the same manner, on demand. A sample of the indexing procedures and a typical printout is appended to this brief report.

At the present time we have most of the organic systems data logged as well as aqueous systems with gaseous and organic solutes. We have not as yet logged high temperature metal data into the system, nor do we have complete coverage of the ionic salt type systems. Much of the machine logging has to await the form of the final retrieval format to insure that all the necessary parameters were on hand for input and codifying.

The method to be used for the critical evaluation posed a most stubborn problem but it appears that we have reached what we feel is an excellent resolution. For "ideal" systems, there is no problem to the evaluation of the data. The main problem centers around non-ideal and associated or solvated type systems. We have just completed work testing a new approach on some 30 non-ideal and associated systems and can report correlation an order of magnitude better than has heretofore been possible. This work is being written up at the present time and a manuscript will be available early this summer. A particular feature of the developed method is that it will be possible to predict association or solvation even in the absence of diffusion data, on the basis of vapor-liquid equilibrium information, and thus also serve as a guide to the appropriate review procedure.

We have also begun to develop a format for contacting private industrial corporations on the possibility of contributing "in-house" data to the library. We feel this could be a significant contribution to the literature available for researchers in the field. While preliminary inquires are out, I do not have any definite information to report in this regard. The early responses have been favorable, but no definite commitments have been received as yet.

DIFFUSION COEFFICIENTS IN BINARY LIQUID SYSTEMS

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CONTENTS

SECTION 1

INTRODUCTORY TEXT

THIS IS A COMPILATION OF DATA ON LIQUID PHASE MOLECULAR DIFFUSION COEFFICIENTS AND IS THE RESULT OF A LITERATURE SURVEY. THE REPORTING OF THESE DATA AND THE METHODS OF STORAGE AND RETRIEVAL DEVELOPED ARE THE INITIAL STAGE OF A PROGRAM DESIGNED FOR CONTINUING TABULATION, EVALUATION, AND REVIEW OF EXPERIMENTALLY DETERMINED LIQUID DIFFUSION COEFFICIENTS AND VISCOSITIES. THIS TABULATION IS DESIGNED TO SERVE AS STANDARD REFERENCE DATA, AS A BASIS FOR TESTING EXISTING THEORY, AND AS A GUIDE FOR THE DEVELOPMENT OF NEW DIFFUSION AND VISCOSITY THEORY.

THE WORK IS PART OF A PROGRAM SPONSORED BY THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION, NASA CONTRACT NO. NGR-20-002-053.

BINARY SYSTEMS INCLUDED ARE...

- AQUEOUS AND NONAQUEOUS SOLVENTS WITH IONIZING SOLUTES
- POLAR AND NONPOLAR ORGANIC SOLVENTS WITH IONIZING OR NONIONIZING SOLUTES
- LIQUID SOLVENTS WITH SLIGHTLY SOLUBLE GAS SOLUTES

IN THIS PRELIMINARY COMPILATION THE EXPERIMENTAL VALUES REPORTED BY THE RESEARCHER ARE UNDISTURBED, EXCEPT THAT...

- TEMPERATURES HAVE BEEN CONVERTED TO CENTIGRADE
- DIFFUSION COEFFICIENTS HAVE BEEN CONVERTED TO THE UNITS 10-5 CM2/SEC
- CONCENTRATIONS HAVE BEEN CONVERTED TO SELECTED UNITS

SELECTIVE RETRIEVAL

IN ADDITION TO THE ENTIRE TABLE, SELECTIVE RETRIEVAL CAN BE MADE OF ALL DATA RELATED TO ...

- A SOLUTE OR A SOLVENT
- A TEMPERATURE
- DIFFUSION COEFFICIENTS AT INFINITE DILUTION (LIMITING VALUES)
- A TYPE COEFFICIENT
- AN EXPERIMENTAL METHOD OF DETERMINATION OF DIFFUSION COEFFICIENT
- A LITERATURE REFERENCE
- REFERENCES BY YEAR

SOLUTE AND SOLVENT DESIGNATION

NOMENCLATURE USED BY THE RESEARCHER IS FIRST DESIGNATED. WHEN THE COMPOUND NAME USED BY THE AUTHOR IS DIFFERENT FROM NOMENCLATURE ADOPTED FOR TABULAR PURPOSES, THE SYNONYM IS GIVEN IN PARENTHESIS.

DESCRIPTIVE MATERIALS, INCLUDING SPECIAL EXPERIMENTAL CONDITIONS, ACCOMPANY THE SOLUTE AND SOLVENT DESIGNATIONS FOR THE SYSTEM.

SOLUTE CONCENTRATION

ALL CONCENTRATIONS ARE IN TERMS OF SOLUTE UNLESS NOTED...

-B	= SOLVENT CONCN.	-X	= ADDITIVE (OR OTHER) CONCN.
M	= MOLAR	MF	= MOLE FRACTION
N	= NORMAL	WF	= WEIGHT FRACTION
G/L	= GRAMS PER LITER	G/G	= GRAMS PER GRAM OF SOLVENT

M/L = MOLES PER LITER M/G = MOLES PER GRAM OF SOLVENT

DIFFUSION COEFFICIENT - TYPE AND METHOD

THE TYPE COEFFICIENT REPORTED, AS DESIGNATED BY THE AUTHOR, AND THE PROCEDURES OF EXPERIMENTATION AND ANALYSIS ARE CODED BY A 6-DIGIT NUMBER. CLASSIFICATIONS ARE MADE ON A GENERAL BASIS AND NUMBERS ARE RESERVED FOR ADDITIONAL AND MORE DETAILED CLASSIFICATION. EACH DIGIT IN THE CODE IS SEARCHED INDIVIDUALLY.

TYPE DIFFUSION COEFFICIENT

COLUMN 1

1 MUTUAL
2 SELF (TRACER)
3 TRACER IN TWO-COMPONENT SYSTEM
9 UNCLASSIFIED

COLUMN 2

1 INTEGRAL (EXPERIMENTAL)
2 DIFFERENTIAL
3 TIME-AVERAGE
4 EFFECTIVE
9 UNCLASSIFIED

EXPERIMENTAL METHOD OF DETERMINATION (CELL CONFIGURATION)

COLUMNS 3 AND 4

00 UNREPORTED

10 FREE DIFFUSION CELL
(CONCENTRATION GRADIENT IS FOLLOWED WITHIN THE CELL)

20 RESTRICTED DIFFUSION CELL
(ANLYSIS IS MADE OR CONTINUED AFTER CONCENTRATION CHANGE HAS OCCURRED)

30 DIAPHRAGM CELL, UNCLASSIFIED
31 DIAPHRAGM CELL, VERTICAL (STOKES-TYPE), STIRRED
32 DIAPHRAGM CELL, VERTICAL (STOKES-TYPE), NO STIRRING
33 DIAPHRAGM CELL, NORTHRUP-ANSON TYPE, STIRRED
34 DIAPHRAGM CELL, NORTHRUP-ANSON TYPE, NO STIRRING
35 DIAPHRAGM CELL, HORIZONTAL, STIRRED
36 DIAPHRAGM CELL, HORIZONTAL, NO STIRRING

40 CAPILLARY CELL, UNCLASSIFIED
41 CAPILLARY CELL, STIRRED
42 CAPILLARY CELL, NO STIRRING

50 POROUS FRIT, UNCLASSIFIED

70 GAS ABSORPTION METHOD, UNCLASSIFIED
71 COLLAPSING BUBBLE
72 PRESSURE-TIME DIFFUSION CELL
73 ABSORPTION INTO LAMINAR JET
74 ABSORPTION INTO FALLING FILM

91 NMR SPIN ECHO

99 UNCLASSIFIED

METHOD OF ANALYSIS
(DETERMINATION OF CONCENTRATION)

COLUMNS 5 AND 6

00 UNREPORTED

10 INTERFEROMETRIC, WITHIN THE CELL, UNCLASSIFIED
11 GUOY DIFFUSIOMETER
12 MACH-ZENDER DIFFUSIOMETER
13 PHILPOTT DIFFUSIOMETER
14 RAYLEIGH DIFFUSIOMETER

20 OPTICAL, WITHIN THE CELL, UNCLASSIFIED
21 COLORIMETRIC
22 MICROSCOPIC
23 POLARIMETRIC
24 SPECTROSCOPIC
25 VISUAL

30 GENERAL, WITHIN THE CELL, UNCLASSIFIED
31 CONDUCTOMETRIC
32 RADIOMETRIC (TRACER COUNTING)

40 OPTICAL, OUTSIDE THE CELL, UNCLASSIFIED
41 COLORIMETRIC
42 POLARIMETRIC
43 REFRACTIVE INDEX DETERMINATION
44 SPECTROSCOPIC

50 GENERAL, OUTSIDE THE CELL, UNCLASSIFIED
51 CHROMATOGRAPHIC
52 CONDUCTOMETRIC
53 DENSITY DETERMINATION
54 GRAVIMETRIC
(INCLUDES LOSS IN WEIGHT OF POROUS FRIT)
55 OSMOTIC PRESSURE DETERMINATION
56 POLAROGRAPHIC
57 RADIOMETRIC (TRACER COUNTING)
58 VOLUMETRIC

70 GAS ABSORPTION RATE MEASUREMENTS, UNCLASSIFIED

91 NMR SPIN ECHO

99 UNCLASSIFIED

EXPERIMENTAL PRECISION

ALL VALUES FOR EXPERIMENTAL PRECISION ARE + OR - PER CENT UNLESS OTHERWISE NOTED...
AV = ABSOLUTE VARIANCE OF EXPERIMENTAL VALUES

REFERENCE FOR DIFFUSION DATA

EACH REFERENCE IS ASSIGNED A UNIQUE NUMBER. IN TABLES 2 AND 3

REFERENCES ARE ARRANGED BY NUMBER WITHIN A YEAR AND ALPHABETICALLY BY PRIMARY AND SECONDARY AUTHORS.

TABLE 1 DIFFUSION COEFFICIENTS IN BINARY LIQUID SYSTEMS

TEMP DEG C	SOLUTE CONCENTRATION		COEFFICIENT X105 CM2/SEC	DIFF TYPE METHOD	PRECISION	REFERENCE DIFFUSION	VISCOSITY	REFERENCE VISCOSITY
SOLUTE 201- 25 BENZENE (C14 LABELED AS TRACER)				SOLVENT 201- 12 CYCLOHEXANE (AND BENZENE)				
25.	0.120	MF-B	1.97	313157	2.	66010		
25.	0.264	MF-B	2.07	313157	2.	66010		
25.	0.419	MF-B	2.22	313157	2.	66010		
25.	0.542	MF-B	2.365	313157	2.	66010		
25.	0.665	MF-B	2.40	313157	2.	66010		
25.	0.779	MF-B	2.30	313157	2.	66010		
25.	0.917	MF-B	2.165	313157	2.	66010		
25.	1.000	MF-B	2.12	313157	2.	66010		
SOLUTE 201- 12 CYCLOHEXANE (C14 LABELED)				SOLVENT 201- 25 BENZENE (AND CYCLOHEXANE)				
25.	0.	MF-B	1.41	313157	2.	66010		
25.	0.226	MF-B	1.75	313157	2.	66010		
25.	0.592	MF-B	2.00	313157	2.	66010		
25.	0.777	MF-B	2.10	313157	2.	66010		
25.	0.908	MF-B	2.09	313157	2.	66010		
25.	0.953	MF-B	2.08	313157	2.	66010		
SOLUTE 102- 30 SILVER NITRATE				SOLVENT 112- 1 WATER				
25.	0.	M	1.7675	113154		66009		
25.	0.0944	M	1.591	113154		66009		
25.	0.1577	M	1.547	113154		66009		
25.	0.2543	M	1.510	113154		66009		
25.	0.2681	M	1.508	113154		66009		
25.	0.3586	M	1.413	113154		66009		
25.	0.5100	M	1.364	113154		66009		
25.	1.0266	M	1.194	113154		66009		
25.	1.5384	M	1.080	113154		66009		
25.	2.0403	M	0.984	113154		66009		
25.	3.0028	M	0.846	113154		66009		
25.	4.0485	M	0.748	113154		66009		
25.	5.1590	M	0.667	113154		66009		
25.	7.0210	M	0.632	113154		66009		
25.	8.9538	M	0.600	113154		66009		

FOLDOUT FRAME 1

FOLDOUT FRAME 2

SECTION 3

TABLE 2 - REFERENCE LIST - NUMERICAL BY YEARS

66001 ALBRIGHT, J. G., J. PHYS. CHEM., 70, 2299 (1966).
66002 BOARD, W. J., AND SPALDING, S. C., JR., AM. INST. CHEM. ENGRS. J., 12, 349 (1966).
66003 BYERS, C. H., AND KING, C. J., J. PHYS. CHEM., 70, 2499 (1966).
66004 CUSSLER, E. L., JR., AND DUNLOP, P. J., J. PHYS. CHEM., 70, 1880 (1966).
66005 DURRILL, P. L., AND GRISKEY, R. G., AM. INST. CHEM. ENGRS. J., 12, 1147 (1966).
66006 GUBBINS, K. E., BHATIA, K. K., AND WALKER, R. D., JR., AM. INST. CHEM. ENGRS. J., 12, 548 (1966).
66007 HATFIELD, J. D., EDWARDS, O. W., AND DUNN, R. L., J. PHYS. CHEM., 70, 2555 (1966).
66008 JANZ, G. J., LAKSHMINARAYANAN, G. R., AND KLOTZKIN, M. P., J. PHYS. CHEM., 70, 2562 (1966).
66009 JANZ, G. J., LAKSHMINARAYANAN, G. R., KLOTZKIN, M. P., AND MAYER, G. E., J. PHYS. CHEM., 70, 536 (1966).
66010 KAMAL, I., AND MCLAUGHLIN, E., TRANS. FARADAY SOC., 62, 1762 (1966)
66011 MILLS, R., AND ELLERTON, H. D., J. PHYS. CHEM. 70, 4089 (1966).
66012 ROBINSON, R. L., JR., EDMISTER, W.C., AND DULLIEN, F. A. L., IND. ENG. CHEM. FUNDAMENTALS, 5, 74 (1966).
66013 SUROFF, G. H., AND SHEMILT, L. W., J. CHEM. ENG. DATA, 11, 183 (1966).
66014 THOMAS, W. J., AM. INST. CHEM. ENGRS. J., 12, 1051 (1966).
66015 WISE, D. L., AND HOUGHTON, G., CHEM. ENG. SCI., 21, 999 (1966).

SECTION 4

TABLE 3 - REFERENCE LIST - ALPHABETICAL BY YEARS

66001 ALBRIGHT, J. G., J. PHYS. CHEM., 70, 2299 (1966).
BHATIA, K. K. SEE GUBBINS, K. E.
66002 BOARD, W. J., AND SPALDING, S. C., JR., AM. INST. CHEM. ENGRS. J., 12, 349 (1966).
66003 BYERS, C. H., AND KING, C. J., J. PHYS. CHEM., 70, 2499 (1966).
66004 CUSSLER, E. L., JR., AND DUNLOP, P. J.. J. PHYS. CHEM., 70, 1880 (1966).
DULLIEN, F. A. L. SEE ROBINSON, R. L.
DUNLOP, P. J. SEE CUSSLER, E. L.
DUNN, R. L. SEE HATFIELD, J. D.
66005 DURRILL, P. L., AND GRISKEY, R. G., AM. INST. CHEM. ENGRS. J., 12, 1147 (1966).
EDMISTER, W. C. SEE ROBINSON, R. L.
EDWARDS, O. W. SEE HATFIELD, J. D.
ELLERTON, H. D. SEE MILLS, R.
GRISKEY, R. G. SEE DURRILL, P. L.
66006 GUBBINS, K. E., BHATIA, K. K., AND WALKER, R. D., JR., AM. INST. CHEM. ENGRS. J., 12, 548 (1966).
66007 HATFIELD, J. D., EDWARDS, O. W., AND DUNN, R. L., J. PHYS. CHEM., 70, 2555 (1966).
HOUGHTON, G. SEE WISE, D. L.
66008 JANZ, G. J., LAKSHMINARAYANAN, G. R., AND KLOTZKIN, M. P., J. PHYS. CHEM., 70, 2562 (1966).
66009 JANZ, G. J., LAKSHMINARAYANAN, G. R., KLOTZKIN, M. P., AND MAYER, G. E., J. PHYS. CHEM., 70, 536 (1966).
66010 KAMAL, I., AND MCLAUGHLIN, E., TRANS. FARADAY SOC., 62, 1762 (1966)
KING, C. J. SEE BYERS, C. H.
KLOTZKIN, M. P. SEE JANZ, G. J.
LAKSHMINARAYANAN, G. R. SEE JANZ G. J.
MAYER, G. E. SEE JANZ, G. J.
MCLAUGHLIN, E. SEE KAMAL, I.
66011 MILLS, R., AND ELLERTON, H. D., J. PHYS. CHEM. 70, 4089 (1966).
66012 ROBINSON, R. L., JR., EDMISTER, W.C., AND DULLIEN, F. A. L., IND. ENG. CHEM. FUNDAMENTALS, 5, 74 (1966).
SHEMILT, L. W. SEE SHROFF, G. H.
66013 SHROFF, G. H., AND SHEMILT, L. W., J. CHEM. ENG. DATA, 11, 183 (1966).
SPALDING, S. C., JR., SEE BOARD, W. J.
66014 THOMAS, W. J., AM. INST. CHEM. ENGRS. J., 12, 1051 (1966).
WALKER, R. D., JR., SEE GUBBINS, K. E.
66015 WISE, D. L., AND HOUGHTON, G., CHEM. ENG. SCI., 21, 999 (1966).

GAS DIFFUSION COEFFICIENTS

The previous six-month summary report indicated that a considerable amount of gaseous diffusion data evaluation was still required; the format for the presentation of results was uncertain, and that a final report might be feasible by the end of 1967. A final report was not completed because we received an extensive report on an accurate investigation of noble gas diffusion coefficients. Furthermore, we were able to extend the upper temperature range of diffusivity for mixtures with polyatomic components using molecular beam results. In addition, the lower temperature range of diffusion coefficients was decreased for all gas pairs which had known London constants. These two semi-theoretical applications of kinetic theory have generated Standard Reference Data for approximately 40 gas pairs over for slightly more than two(2) decades of temperature. It is now estimated that it will take the entire summer to write the report on this evaluation of gaseous diffusion coefficients.

The format for the presentation of results will consist of several means. The accuracy of gaseous diffusion data has been classified according to percent uncertainty, as a function of temperature, for each gas-pair. The most accurate Standard Reference Data (SRD) is estimated to be $\pm 1\%$ or better at room temperature, $\pm 2\%$ at temperatures $< 90°K$, $\pm 5\%$ at 1000°K, and $\pm 10\%$ at 10,000°K. Two other categories, over the same temperature range, have been assigned for less accurate data. These correspond to $\pm 2\%$ and $\pm 3\%$ uncertainties at room temperature. A fourth SRD category is for good diffusion measurements available only over a very limited temperature range. These four categories comprise the classification of SRD for specific gas pairs. Unfortunately, this scheme does not include a volummous amount of published results which are not considered sufficiently accurate for Standard Reference Data. Such poor measurements will be included in a separate annotated bibliography.

The evaluated SRD will be presented in simple equation form. A mathematical equation was developed which would have a goodness of fit consistent with the above accuracy categories. The expression obtained has the following general form.

$$D_{12} = \frac{AT^{s}}{[\ln (\frac{T}{B})]^{2}\ e^{C/E}e^{E/T^{2}}}$$

The numerator alone fits the data of many gas pairs well; this as a simple straight line on a log D_{12} vs. log T graph. The terms in the denominator are necessary to modify $D = AT^{s}$ in systems which have data over a wide temperature range. Data over a wide temperature range elucidates molecular collision effects where the attractive and upulsive forces are signigicant. The terme $e^{C/T}$ $e^{E/T^{2}}$ account for attractive forces which are most important at temperatures about room temperature or lower. This form is approximately equivlaent to the well-known Sutherland correction. The other, denominator factor, $[\ln (\frac{T}{B})]^{2}$, is for repulsion forces effective at very high temperatures, say temperatures greater than 1000°K. It is approximately the form for molecules with exponential repulsion. The above general equation has been fitted to data for approximately 40 gas pairs. In addition to this temperature relation for SRD diffusion coefficients, another equation applicable at very low temperatures, say in the order of 100°K, has also been developed for gas pairs which have known London constants. It has the form $D_{12} = \alpha\ T^{11/6}$ low temperature asymptote of gaseous diffusion coefficients assumes that only long-range attractive forces predominates during intermolecular collisions.

A third general mathematical expression has been developed which accounts for the composition dependence of the diffusion coefficient. The expression is

$$\Delta + (a)\ (6C^*_{12} - 5)^2\ (\frac{x_1}{1+cx_1})$$

where

$$D_{12}(x) = D(x = 0.5)\ \{\frac{1+\Delta(x)}{1+\Delta(x=0.5)}\}$$

and x = mole fraction

x_1 = mole fraction of heavy component

a,c = semi-theoretical constants for specific gas pairs.

The parameters, a and c, have been determined for about 70 gas pairs. The value of C^*_{12} is based on the Lennard-Jones (12-6) potential and is readily available from the literature.

In order to complement the presentation of results in equation forms, graphs of the deviations of the data from the SRD equation will also be prepared. For this purpose, a digital plotting system (CALCOMP) has been learned. Finally, for each gas-pair qualifying remarks will be made such that the basis of data selection will be well understood and amenable to any future additions by more accurate measurements. The total format for the presentation of results as here envisioned is consistant with the existing SRD publications of other physical properties.

The evaluation and synthesis of accurate gaseous diffusion coefficient data has confirmed the principle of corresponding states. A set of accurate data for 10 noble gas pairs and H_2-N_2 was most recently received by personal commnnication (Van Heynmgeir, R. J. J., thesis, University of Leiden (1967); published in Physica 38, 1 (1968)). These results along with diffusion coefficient values from molecular beam data and known London constants have an extremely wide temperature range. The results were considered relative to helium-argon and by application of kinetic theory the data for all these gas pairs reduced to one curve as a function of reduced temperature. At very low temperatures, where classical behavior is effected by quantum effects, the quantum deviations were evident in the diffusion collision initegral. A method was also developed to estimate the quantum correction as a function of temperature and the deBoer parameter. The synthesis of a corresponding states argument from the diffusion coefficient data is still preliminary; it is expected to be completed only after the SRD report is prepared.

Diffusion in Polymer-Diluent Systems

The program to compile and evaluate diffusion coefficients in polymer-diluent systems has progressed as planned. At the present time data and references are being codified and placed on cards. We plan to use these cards to produce several types of data print out in tabular form and also to print bibliographies.

Work continues on abstracting and evaluating data. We have not had as much success as we had hoped in evaluating data because many systems have not been adequately described. We feel that we can have a final report ready by the latter part of 1968.

Diffusion in Inorganic Solids

The compilation of self-diffusion data in the alkali halides is continuing. The large active body of literature in this field is being plotted and correlated with a least squares curve fitting computer program. This enables the data to be reduced to numerical form and to place confidence limits on the activation energy and pre-exponential terms in the equations. On the basis of these analysis coupled with critical review of the experimental work we hope to complete our selection of the best available equations for anion and cation self-diffusion coefficients within the next few months.

Turbulent Transport Coefficients

We have accumulated and cataloged copies of nearly all publications containing turbulent transport data published during the past ten years. Work is now underway on abstracting and evaluating the data. This process of compilation and evaluation is now the major activity of this portion of the program.

Personnel

The investigation of diffusion in gases is directed by Dr. E. A. Mason. He is assisted by one graduate student, Mr. T. R. Marrero.

The liquid diffusion survey is directed by Dr. R. B. Beckmann with the assistance of two graduate students, Mr. D. K. Harris and Mr. P. N. Vashist, and a part-time research associate, Mrs. M. C. Bailey.

The investigation of diffusion in inorganic solids is directed by Dr. L. P. Skolnick. He is assisted by one graduate student, Mr. G. Slawecki.

The polymer diffusion survey is directed by Dr. T. G. Smith, with the assistance of a graduate student, Mr. Ronald Heck.

Dr. J. M. Marchello is directing the turbulent transport survey and is assisted by one graduate student, Mr. E. F. Logan.