〔17 Aa 1〕
TURBULENT TRANSPORT MEASUREMENTS WITH A LASER DOPPLER VELOCIMETER

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The van Hove space-time correlation function of the turbulent flow is now experimentally accessible using laser doppler velocimeters. This is in contrast to hot wire methods which conventionally measure velocity correlation functions. The implications of the new laser technique for fundamental research in turbulent transport are examined.

In an earlier study (1) the authors developed the theoretical foundation of the laser doppler velocimeter by describing the motion of the scattering centers with the van Hove space-time correlation function from classical, inelastic scattering theory. In the present paper we model the stochastic properties of the turbulent flow by assuming a gaussian form for the space time correlation function. We show that under normal conditions, i. e., scattering vectors from 10^4 to $10^5\,cm^{-1}$, the spectrum of scattered light is primarily determined by the average velocity, velocity probability distribution function and the sample volume size and shape. Conditions under which the entire space time correlation function may be determined from laser light scattering experiments are examined. The turbulent flow of water was studied using two independent laser doppler velocimeters. The water was seeded with a low concentration of polystyrene latex spheres to enhance the scattered light intensity. The data were analyzed using the above formalism. The parameters of the flow were found to agree closely with results from investigations using conventional techniques.

〔17 Aa 2〕
EFFECT OF TEMPERATURE JUMP ON MEASURING THE THERMAL CONDUCTIVITY OF GASES

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A method of correcting for the effect of temperature jump at the interface of the fine wire and the surrounding gas was developed from the theoretical point of view to be used for processing the data obtained by the frequency response technique for measuring the thermal conductivity of gases at low pressures. The method was applied to the data obtained with the alkali metal vapors.

〔17 Aa 3〕
EFFECT OF CONCENTRATION ON DISTILLATION EFFICIENCY

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Experiments were carried out to observe the effect of concentration on the performance of a 3 inch diameter sieve plate column. The column had six plates with external downcomers. Each plate contained 200 holes of 1.5mm diameter on 4.5mm triangular pitch. Two sets of downcomers were employed to give two different weir heights of $\frac{1}{2}$ and 1 inch.

The overall column efficiency was not affected greatly with composition over the major part of the concentration range, but the efficiency increased fairly rapidly especially when the lower weir height was used. The result was explained in terms of liquid mixing and interfacial area.

It is also shown that some varying reports of efficiency behaviour at the extreme of the concentration range are the result of a systematic error in the vapour-liquid equilibrium data.

〔17 Aa 4〕
MIXING PROBLEMS FOR HIGH VISCOSITY FLUIDS IN POLYMER PRODUCTION PROCESSES

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There have been a few studies on high viscosity mixing devices. However, there exists no universally accepted technique for evaluating their functional status in the light of generalized basic information such as the flow patterns, shearing and tensile deformation charcateristics in the mixing equipment. The first part of this paper gives a physical meaning to the mixing number $C_1=nT_M$ and the shearing amount, $C_2=T_H\sqrt{\frac{P_s g_c}{M}}$ by using a simplified W. O. Mohr's striation thickness theory.

The second part of this paper, the degee of surface renewal action is studied by comparing the value estimated from the flow patterns on a free surface of a liquid with that from a gas absorption chracteristics. The third part of this paper gives a review for heat transfer problems some considerations on discrepancies between different investigators in heat transfer problems Newtonian and non-Newtonian fluids.

〔17 Aa 5〕
VISCOSITY OF CONCENTRATED SUSPENSIONS —INERTIAL EFFECT—

K. J. Lee, *Dept. of Chem. Engr., Seoul National Univ., Seoul, Korea* and N. F. Sather, *Univ. of Washington, U. S. A.*

A statistical mechanical theory is described for the random motion of particles in suspension and some results are derived therefrom for the viscosity of concentrated suspensions of solid spherical particles. Since an exact determination of the flow field is impractical to obtain for grou s of more than two particles, an approximate statistical model is developed. On this basis, the hypothesis that the observed non-Newtonian behavior of suspensions is a manifestation of fluid and particle inertia is examined.

〔17 Aa 6〕
KINETIC THEORY UNDER EXTERNAL FIELDS

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Kinetic theory based upon the classical Boltzmann equation is applied to the analysis of (1) Senftleben-Beenakker (SB) effects upon the thermal conductivity and viscosity, (2) thermomagnetic torque (TMT) effect of polyatomic gases. New and correct predictions are shown to be in better agreement with recent TMT experiments. Collision integrals are calculated from SB experimental data.

〔17 Aa 7〕
THE EFFECT OF BUBBLE AND PARTICLE SIZES IN MINERALIZATION ON THE RATE OF SINGLE BUBBLE FROTH FLOTATION

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This investigation is concerned with the effect of air bubble and particle sizes in mineralization on the rate of single bubble froth flotation.

In the motion of air bubble, the relative rising velocities of equivalent mean bubble radii smaller than the critical radius were linearly increased with bubble sizes, which followed Allen's equation, and for those larger than the critical radius the velocity profiles were also shown as followed Mendelson's modified surface wave equation.

This study also observed that the typical properties such as air bubble and particle sizes, concentration of frother in the pulp soluton, functional hydrodynamic relations, and induction period were greatly influenced on the mineralization of air bubbles. In addition to this, an empirical equation of the induction period necessary for air bubble-mineral adhesion was newly derived as a function of air bubble and mineral particle radius with experimentation.

〔18 Am 1〕
SOLUTION OF ABSORBER, STRIPPER, AND LIQUID-LIQUID EXTRACTION PROBLEMS BY USE θ-METHOD OF CONVERGENCE

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This paper demonstrates the application of the θ-method of convergence to the solution of absorber, stripper, and liquid-liquid extraction problems. By the solution of a wide variety of examples, it is demonstrated that the θ-method is exceedingly fast and converges for all problems of the type which appear to be of commercial interest.

〔18 Am 4〕
DIFFUSION IN AND ON SOLID OXIDES

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Electron microprobe analysis was used to measure the distribution profile of nickel ion in and on the spinel layer during the spinel formation reaction from nickel oxide and alumina single crystals in the temperature range from 1260° to 1470°C. The volume and surface diffusion coefficients of nickel ion (Dv, Ds) obtained are:

$$D_v = 8.54\times10^{-4}\exp\left(-\frac{48.6\pm5.8\ \text{kcal/mol}}{RT}\right)\ \text{cm}^2/\text{sec},$$

$$D_s = 2.7\times10^{-1}\exp\left(-\frac{20.5\pm1.2\ \text{kcal/mol}}{RT}\right)\ \text{cm}^2/\text{sec}.$$

A confits model was proposed for measurement of surface diffusion coefficient under free sintering of powder and the application was carried out for free sintering data of ZnO.

〔18 Aa 1〕
SALT EFFECTS IN VAPOR-LIQUID EQUILIBRIUM FOR METHYLACETATE-METHANOL SYSTEM

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To investigate salt effects in vapor-liquid equilibrium for methylacetate-methanol system, sodium acetate, potassium acetate and mercuric chloride were used as salts.

The solubilities of each salt in boiling methylacetatemethanol solution and vapor-liquid equilibrium data for methylacetate-methanol saturated with salts were measured experimentally, and studied on relative volatilities.

〔18 Aa 2〕
RELATION BETWEEN BINARY EXCESS VOLUME ON MIXING AND SOLVENT SELECTIVITY IN TERNARY EXTRACTION SYSTEM

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〔18 Am 2〕
STUDIED ON THE MASS TRANSFER AND THE VACUUM CONDENSING POINT OF SUBLIMATOGRAPHY -Ⅲ- RELATIONS AMONG THE CHARACTERS OF SULFUR IN THE SUBLIMATO-TUBE-

J. U. Sohn and J. B. Kim, *Dept. of Chem. Engr., Dong-A Univ., Pusan, Korea*

We studied on the sublimatographic characters of sulfur as follows;

1) Vacuum condensing point of sulfur at different heating temperatures and vacuum degrees were obtained.

2) Quantity (G) of sublimation of sulfur were determined quantitatively by the sublimatography.

3) The vapor pressures (P, P), molar velocity (N) of sublimation and mass transfer coefficient (kg) of sulfur were calculated by the experimental data as follows;

$P_s/P_s = \gamma$ $(\gamma = 1.03)$
$\log P_s = kG$ $(n = 0.977)$
$\log (P_s)n' = k'G$ $(n' = 1.0)$
$k_{exv} = 1.3985\times10^{-2}$

〔18 Am 3〕
SIMULTANEOUS HEAT AND MASS TRANSFER IN GAS ABSORPTION: SYSTEM NH_3 -AIR-H_2O

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The differential equations describing simultaneous heat and mass transfer in gas absorbers were solved by use of a digital computer. Heat and mass transfer rates were related by using the j-factor analogy. The computer solution gave temperature vs. composition profiles for the column. The computer results were compared with experimental data taken in a sieve-tray absorber and in a packed absorber using the system NH_3-AIR-H_2O.

The exess volume of mixing was determined by pycnometric technique for ketone-solvent and acetic acid-solvent systems. The systems investigated were acetone-solvent (*n*-heptane, chlorobenzene, 1, 1, 2-trichloroethane, and water), 2-butanone-solvent (the same solvent written above), and acetic acid-solvent (n-butylalconhol, 2-butanone, ethylacetate, toluene, benzene, 1, 2-dichloroethane, cyclohexane, *n*-hexane, and carbon tetrachloride).

These data were obtained at 25°C under atmospheric pressure over the entire range of compositions in ketone-solvent and at the infinite dilution of acetic acid in acetic acidsolvent systems.

The data obtained were reviewed by R. H. Ewell's classification of liquids from the point of hydrogen bond formation in the binary systems. The results which were obtained at infinite dilution from the data nearly coincide with distribution coefficients from literatures. It was found out the fact that solvent selectivity was able to be guessed from the excess volume of mixing.

〔18 Aa 3〕
THE DRIERITE-WATER VAPOR SORPTION THERM

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The sorption therms for noist air and Drierite (B-$CaSO_4$) were determined at one atmospheric pressure and 90, 100, 125, 150, 175 and 200°F. The system was explained by Hey's theory. The distribution function of Polanyi's potential theory may also represent the system. The best discription, however, can be made by the modified Hey's isotherms which is multi-Lagmuir expression.

〔18 Aa 4〕
THE REQUIRED CRUSHING ENERGY OF BALL-MILL BY HARDNESS

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So many papers were reported concerning dry-crushing by Ball Mill, but only a few reports were investigated with regard to the influence of crushing energy with hardness.

From this standpont, we investigated with various ball sizes, crushing time, r. p. m. of rolls with the results as follow;

1) The required crushing energy increased as the hardness of raw materials (Clinker, Talc, Sand, Coal, Soda-ash) were increased.

2) In some range, crushing time had the limitation, and more than the limitation, it not depend on crushing time.

3) The efficiency of crushing was varied as the weight of the balls in the drum increased.

〔18 Aa 5〕
THE IRRADIATION PHENOMENA OF METHYLSILOXINES ADSORBED ON SILICA

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Studies of the decomposition ay γ-radiation of materials adsorbed on chemically inert mineral supports have shown that excitation energy delivered to the solid from the radiation can migrate to the surface and become available for decompoition of the adsorbate.

These studies cover the effects of dose, the effects associated with the chemical nature of the silica surface, surface coverage by adsorbate, particle size of silica, and energy transfer in the siloxane-silica system.

〔18 Aa 6〕
MOLECULAR THERMODYNAMICS OF LIQUID ARGON

W. K. Kim, *Dept. of Chem. Engr., Soong Jun Univ., Seoul, Korea*

Liquid apparently contains holes which are chiefly of molecular size. Such a hole confers gas-like properties on a molecule surrounded by it. In addition each moleculehole pair contributes a solid state degeneracy. With these ideas of the hole theory it has been possible to derive a partition function for the liquie argon which gives the thermodynamics over the entire temperature range from melting point to critical point.

[17 Ba 1]
PROCESSING OF SUPER CEREAL DRYING OF SUPER CEREAL IN FLUIDIZED BED

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A multistage fluidized dryer system of the super cereal plant has been constructed.

In the drying process, water content of the cooked kernel of wheat is ruduced from 20~24 % to about 15 %, and conversion of amylose contained in the endosperm to α-amylose is to be completed by contacting with the hot combustion gas at 100~120°C.

In this report design procedure and operation conditions of the fluidized dryer system (production capacity : 500 tons/day) will be explained.

[17 Ba 2]
DIMETHYL SILICONE FLUID FROM FERROSILICON

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Dimethyl dichlorosilane was first obtained by reacting ferrosilicon (silicon=70. 0 % and iron=25. 9 %) with methyl chloride which was synthesized and purified previously. The reaction was carried out best in a vertical glass tube, passing the methyl chloride through the pallets of ferrosilicon at a rate of 40~42. 5 cc/min and at 330±10°C, using 10 % of copper powder as a catalyst and 1. 7 % of zinc chloride as a promotor. Thus obtained silane was hydrolyzed and polymerized using 98 % sulfuric acid as a catalyst and trimethyl chlorosilane as a terminant. The viscosity range of the silicone fluids was governed by the amount of terminant used.

[17 Ba 3]
NEW POLYMERS FROM POLYMERIZATION OF ACROLEIN WITH PHENOLS AND AMINES

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Polymerizations of acrolein with phenols and acrolein with amines, and the haracteristics of those polymers were investigated. The polymers of acrolein with phenols, e. g., phenol, m-cresol and hydroquinone were prepared when the reactions were carried out at 50~120°C, for 3~8 hrs. under strongly acidic conditions. Polymerization of acrolein with aniline at 25°C for 30~60 minutes resulted in thermoplastic polymer of low molecular weight, and that of acrolein with benzidine and 4,4′ methylene dianiline at 0~20°C for 30~60 minutes also yielded brown cross-linked polymers. The characteristics, such as electrical insulating properties, thermostabilities, adhesive and mechanical properties of those polymers were determined. Among the various kinds of the above properties, the new polymers had the excellent electrical insulating properties (e. g., surface resistivity, more than $10^{14}\Omega$), thermostability (more than 250° C) and valcanizing abilities for rubbers.

[17 Ba 4]
REGENERATION OF CAUSTIC SODA FROM LIQUID WASTE OF OIL REFINERY

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A new process for the treatment of spent caustic solutions discharged from the oil refinery and naphtha cracking unit is under development.

The basic idea of the SNU process is to obtain crude sodium carbonate solution by carbonating the spent caustic solution with high temperature gas obtained from the submerged flame combustion unit, and causticize the sodium carbonate solution to regenerate the caustic soda out of it.

The plant cost is estimated based on the engineering flow sheet and detailed drawings of main equipment in the case of treatment capacity of 2, 240 tons caustic soda per year.

[17 Ba 5]
THE EFFECT OF DERIVATIVES OF NITROBENZENE ON THE POLYMERIZATION OF VINYL MONOMERS

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The polymerizations of methylmetacrylate and styrene were carried out at 60°C in the presence of various terminators (p-nitrobenzene, dinitrobenzene, trinitrobenzene).

Correlation of the effects and the structure of terminators were discussed.

The copolymerization of styrene and methylmetacrylate have also been studied in the presence of terminators.

The copolymer composition was analyzed by U. V. spectrophotometer and the effects of terminators on the copolymer composition were discussed.

[17 Ba 6]
THE SYNTHESIS OF PLASTIC ADDITIVES CONTAINING STABLE FREE RADICAL

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We synthesized a homolog and some plastic additives containing 2, 2, 6, 6-tetramethylpiperidine (I) and its N-oxyl (II) which was known as stable free radical.

4-oxo-2, 6, -dimethyl-2, 6-diethylpiperidine (111) and its N-oxyl (IV), the homologs of (I) and (II), synthesized.

And two heteroclic azonitriles containing (I) for polymerization initiator and foaming agent, and (II), for foaming agent and inhibitor were synthesized.

And 9 phthalic diesters containing (I) and (II) were also synthesized for stabilizer.

Finally we synthesized high polymers containing (II) in short polymerization time with high yield.

[19 Cm 1]
STRUCTURES AND PROPERTIES OF ELECTROLYTES AQUEOUS SOLUTIONS. I. ON THE PARTIAL MOLAL VOLUME AND VISCOSITY OF POTASSIUM CHLORIDE IN ETHANOL-WATER MIXTURES

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The partial molal volumes and relative viscosities of potassium chloride in a series in ethanol-water mixtures have been determined as a function of temperature over ranges 30, 35 and 40°C. The results are discussed in terms of partial molal volums, viscosity B-coefficients calculated from the Jones-Dole equation, energy and entropy of activation is maximum at 0. 2 mole fraction ethanol. The empirical limiting slope is positive small values over ranges 0. 0-0. 4 mole fraction of ethanol examined, and the maximum values are observed at 0. 3 mole fraction composition. The cationic partial volume is maximum, while the anionic partial molal volume is minimum at 0. 3 mole fraction, and so are partial molal volume of salt. Negative B values are found with these ions which exert a "structure-breaking" effect on water. e. g., K^+, Cl^- and such values become less negative or even change to positive as the temperature is raised.

[19 Cm 2]
THE CORRELATION BETWEEN RELATIVE VOLATILITY AND LIQUID COMPOSITION IN VAPOR-LIQUID EQUILIBRIUM FOR TERNARY SYSTEM

W. K. Park, K. S. Do and B. Y. Chung, *Dept. of Chem. Engr., Yeung Nam Univ., Daegu, Korea*

To determine vapor-liquid equilibrium data in ternary system, the relation between the logarithmic values of relative volatilities and the liquid composition in binary system was applied to ternary system as following forms.

$$\log\ (\alpha_{12})_3 = A_1 X_{12} + B_1 \qquad (\alpha_{12})_3 = \frac{Y_{12}}{1-Y_{12}} \cdot \frac{1-X_{12}}{X_{12}}$$

$$\log\ (\alpha_{13})_2 = A_2 X_{13} + B_2 \qquad (\alpha_{13})_2 = \frac{Y_{13}}{1-Y_{13}} \cdot \frac{1-X_{13}}{X_{13}}$$

where $X_{12} = \frac{x_1}{x_1+x_2}$, $Y_{12} = \frac{y_1}{y_1+y_2}$, $X_{13} = \frac{x_1}{x_1+x_3}$, $Y_{13} = \frac{y_1}{y_1+y_3}$