## Effect of Diffusion on Energy Transfer in Liquid Organic Scintillators

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A mathematical model is described to determine for solutions the effect of diffusion on the dipole-dipole mechanism of energy transfer. The resulting correlation enables to calculate the energy transfer rate constant at given values of the "critical interaction distance" between the molecules, the life-spans of the interacting donor molecules, and the diffusion coefficients of the molecules in each solution.

A study of the effect of viscosity on sensitized luminescence of liquid scintillators is summarized in some detail.

## Investigation of Low Temperature Radiolysis of Simple Aromatic Compounds with the Aid of EPR and Mass Spectrometric Methods

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The yields of the radicals, $G_{\dot{R}}$, and of the hydrogen, $G_{H_2}$, in low temperature radiolysis of benzene, diphenyl, and of some derivatives of these two compounds—were determined with the aid of the EPR and mass-spectrometric methods. The results show that for aromatic compounds the $G_R$ values are appreciably greater than the $G_{H_2}$. The observed disparity between the $G_R$ and $G_{H_2}$ values for the substances investigated is explained by occurrence of typical to aromatics secondary reactions of the hydrogen atom addition at the double bonds of the aromatic ring.

## Effect of Additives on Physico-Chemical Properties of Solids: Effect of $Pb^{++}$ and $Co_3^=$ Additives on Some of the Properties of Silver Azide

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Addition of $Pb^{++}$ and $CO_3^=$ to silver azide ($AgN_3$) changes some of its properties. Thus, addition of $Pb^{++}$ increases the photochemical stability and dielectric strength of the azide and decreases its electroconductivity and light absorptivity in the wavelength range of 2,200–3,400 A. Addition of $CO_3^=$ produces the opposite changes. The thermal and radiative stabilities of $AgN_3$ are not noticeably altered by introduction of these additives.

The observed effects are explained in terms of the nature of the lattice defects produced by introduction of these additives and of characteristics of the mechanisms of thermal decomposition and photolysis of silver azide.

## Kinetics of Reduction of Tin Dioxide by Carbon Monoxide

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The continuous reduction kinetics of three different samples of tin dioxide by carbon monoxide were studied at temperatures of 500°–1000°.

The $SnO_2$ reduction kinetics can be expressed by the equation, $1\text{-}(1\text{-}\alpha)^{1/3} = kt$, assuming that specific velocity of spherical particles remains constant. The relation between $SnO_2$ reduction rates and CO pressures is expressed by the equation, $k = k'p^n_{CO}$. Apparent activation energy values for the three samples tested varies between 26 and 42 kcal/mol.

Studies of properties of tin monoxide at 300°–1,000° show that at temperatures above 460° solid SnO disproportionates into Sn and $SnO_2$.

The results also show that volatilization of tin occurring during reduction of $SnO_2$ is tied to the formation of gaseous tin monoxide as an intermediate product.

## Use of EPR Method in Studies of Properties of Irradiated Ammonium Perchlorate

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The properties, accumulation, and recombination of paramagnetic centers were investigated at temperatures of 150°–400°K. These centers were produced by ionizing radiation in pure ammonium perchlorate, $NH_4ClO_4$, and in the perchlorate with added CaO, $MnO_2$, and $KMnO_4$. A relationship exists between the properties of the radicals produced in irradiating $NH_4ClO_4$ and those formed by thermally decomposing this compound.

## Reaction Kinetics of Heterogeneous Catalyses

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The merits of a certain generalized approach to characterize kinetics and mechanism of hetero-

geneous catalytic reactions are considered, using simple processing stage models based on Bodenstein Principle and graphical solution methods.

Usefulness of the magnetochemical data is discussed as a possible means to sharpen the accuracy and intensity of chemical reaction mechanisms.

Decomposition of ammonia over tungsten and iron catalysts and oxidation of ethylene over a silver catalyst are discussed to illustrate the concepts of this work.

## Effect of Spinel Formation Upon Catalytic and Electrical Properties of Nickel Oxide–Chromium Oxide Systems

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Magnetic and electrical properties of nickel oxide-chromium oxide mixtures were determined after air calcination at various temperatures and after treatment with formic acid. Catalytic activity of these oxide mixtures was determined. Based on the initial rate measurements, no specifically active state was found for decomposition of formic acid.

Catalytic decomposition of HCOOH over metallic nickel on oxides of nickel and chromium was determined as a function of the support calcination temperatures. The catalyst with the smallest activation energy is nickel on the supports precalcined at 800°. This observation and the study data of the electrical properties of the oxide mixtures emphasize the singularity of the state originating during the spinel formation stage.

## Properties of Nickel Oxide, Produced by Decomposition of Nitrate Salts, and of Its Alloys with Lithium and Iron

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Samples of pure nickel oxide and of its alloys with lithium (0.17–5.5 atom %) and iron (0.1–3.0 atom %) were prepared by calcination of nickel nitrate at temperatures of 500°–1,000°. Excess oxygen in the samples was determined immediately after air-calcination and after vacuum desorption of the oxygen at a temperature of 400°. The amounts of desorbable oxygen were determined for the surface and the sub-surface layers; the determination also included the excess oxygen in the intra-crystalline lattice of nickel oxide. The results obtained shed light upon the mechanism of lithium diffusion into the intercrystalline lattices. The results of electroconductivity measurements of the samples in air and in vacuum are also listed.

## Activity, Structure, and Electrical Properties of Mixed Vanadium Catalysts

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Activities of the following mixed oxides to catalyze oxidation of benzene to maleic anhydride were determined: $V_2O_5 + MoO_3$; $V_2O_5 + Cr_2O_3$; $V_2O_5 + Co_2O_3$; $V_2O_5 + P_2O_5$; $V_2O_5 + Li_2O$; $V_2O_5 + Rb_2O$. The structures of these mixed oxide catalysts were determined by the EPR and roentgenographic methods. The electron work functions of these mixed oxides were evaluated. A relationship was established between the activities and the structural and electronic properties of these catalytic complexes. The $V^{+4}$ ion-containing solid solutions in a crystal lattice of $V_2O_5$ show the greatest activity and selectivity. The chemical compounds produced on mixing these oxides had somewhat smaller activities. Activities of the catalysts increase with increasing values of their work functions.

## A Mechanism of Catalytic Hydrocarbon Oxidation Over Cobalt Salts

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The kinetics of oxidation of methyl oleate, diphenyl methane, cyclohexene, cumene, and n-decane were studied, using a solution of cobalt acetate in glacial acetic acid as the catalyst. Except for n-decane, these oxidation reactions follow identical kinetic principles. Also, the results show that in oxidation of methyl oleate and of diphenyl methane, the catalyst plays active role in the reaction initiating stage only, that of interaction with the hydroperoxide; however, it does not participate in either the promotion or stoppage of the chain reactions.