Some of the governing principles were determined in oxidative ammonalysis of propylene to acrylonitrile (Reaction I) and in oxidation of propylene to acrolein (Reaction II), using a recycle-continuous unit and a bismuth-molybdenum catalyst. Kinetically, both reactions are of the first order with respect to propylene; with respect to oxygen, both are of the zero order, provided that the partial pressure of the oxygen is not below a specified minimum value. The results show that Reaction I is not retarded by the reaction products; Reaction II, on the other hand, is retarded by the acrolein product. The reaction rates of the two processes become practically identical, when the acrolein, produced in Reaction II, is continuously removed by freezing out. The effect of varying partial pressure of the ammonia on the product composition was determined for Reaction I. It is believed that formation of different nitriles in Reaction I is via formation of the corresponding aldehyde intermediates.

Effect of Chemical Composition and of Methods of Preparation on Physico-Chemical Properties of Complex Oxide Catalysts: Silica-Magnesia Catalysts

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The structure and phase composition were determined for several samples of silica-magnesia catalysts. The investigation shows that during the preparation these catalysts form a specific silicate structure with the magnesium atoms in a lowered (quaternary) coordination relative to the oxygen.

The effects of chemical composition and of methods of preparation on catalytic activity were evaluated in dehydration of isopropyl alcohol. The greatest concentration of acidic centers was found in the catalyst samples with the highest content of the four-coordinated magnesium. Activity of a milliequivalent of the acid centers is not affected by the composition of the silica-magnesia catalysts tested.

Catalytic Properties of the Oxides of Metals of Period IV of Periodic Table in Oxidation Reactions: Decomposition of Nitric Oxide

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Catalytic properties of different transition metal oxides (TiO_2; V_2O_5; Cr_2O_3; MnO_2; Fe_2O_3; Co_3O_4; NiO; CuO; ZnO) were determined by statistically evaluating the results of decomposition of nitric oxide in a recycle-continuous unit. The order of the reaction with respect to NO and the reaction rate-temperature relationship were determined.

Effect of Platinum and Sodium Content on Aromatization Activity of Pt/Al_2O_3 Catalysts

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The effects of 0.01–1.2% (wt) Pt and 0.02–1.6% (wt) Na on properties of Pt/Al_2O_3 catalysts were determined in aromatization of n-hexane at atmospheric pressure and a temperature of 545°. In addition, conversion of n-hexene-1 was studied over an Al_2O_3 catalyst at the conditions above.

Various schemes of formation of alkyl aromatics from n-hexane were considered. A scheme for conversion of n-hexane over a Pt/Al_2O_3 is described, which assumes concurrent formation of alkyl aromatics on both the Pt and the acidic centers. The experimental data presented show that the optimum concentration of sodium is a function of the Pt content in the Pt/Al_2O_3 catalysts.

Activity of Ferric Oxide-Molybdena Catalysts in Oxidation of Methanol to Formaldehyde: Specific Activity as a Function of Composition

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A study of the effect of chemical composition of ferric oxide-molybdena catalysts on specific catalytic activity in oxidation of methanol to formaldehyde demonstrates the non-additivity of the catalytic properties of the starting components and of individual catalysts in a mixture. The catalysts with the Mo/Fe ratio of about 1.7 have the greatest activity for conversion of methanol to formaldehyde. It is believed that the active component of this catalyst is a chemical compound of iron and molybdenum oxides, containing about 60% of Mo.

Mechanism and Kinetics of Carbon Monoxide-Steam Reaction Over a Ferric Oxide-Chromia Catalyst

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The kinetics of conversion of carbon monoxide in different concentrations in the reaction mixture were investigated over a ferric oxide-chromia catalyst at atmospheric pressure and temperatures of 390–483°. The experimental data of this study are in good agreement with the data calculated by use of Equation 24, which is based on the assumption that the reaction occurs in two steps.

The results calculated by use of Equation 24, modified for continuous operation, are compared with published experimental data.

The Nature and Causes of Aging of Chromia-Ferric Oxide-Zinc Oxide Catalyst

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The properties of fresh and of completely spent samples of a chromia-ferric oxide-zinc oxide catalysts, used in dehydrogenation of n-butylenes and of divinyl, was determined by physical methods. The samples have a chromia-spinel structure. The phase compositions of the fresh and the spent samples do not show any substantial differences. Specific catalytic activities of the fresh and of the spent samples were found to be equal. The loss of activity and aging of the catalyst are associated with a decrease of specific surface due to recrystallization.

Isotherms and Heats of Adsorption of Vaporized Benzene on Argillaceous Minerals

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The isotherms and differential heats of adsorption of vaporized benzene on montmorillonite, kaolinite, metahalloysite, and ferrihalloysite were determined at a temperature of 20°, using an adsorption calorimeter equipped with a heat exchanger.

The results show that the saturation volume of adsorbed benzene vapor decreases with increasing evacuation temperatures of each mineral, except for kaolinite—where the reverse is true.

With kaolinite and metahalloysite, the differential heat of adsorption curves pass through a maximum point, whereas with montmorillonite and ferrihalloysite, the curves continuously rise. With increasing evacuation temperatures, mobility of adsorbed benzene molecules changes relative to their mobility in liquid state. The shape of the entropy curves provides the information regarding the benzene adsorption mechanism over the argillaceous minerals investigated.

Structure of Aluminum Oxides

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A study of the phase composition and structure of the products of thermal decomposition of aluminum hydroxides at temperatures of 300–950° reveals evolutionary character of transformation of the crystal lattice of aluminum oxide. The multiplicity of Al_2O_3 forms is discussed, based on the results of X-ray analyses. It is concluded that two polymorphic modifications of aluminum oxide exist: one, comprising the densest cubic packing of the oxygen ions, is formed at a low temperature; the other one, the corundum form, comprising the densest hexagonal packing of the oxygen ions, is formed at a high temperature.

Determination of Specific Surface of Solids by Thermal Desorption of Argon

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An improved chromatographic technique of thermal desorption is described to determine specific solid surfaces of 0.01 to 600 m^2/g, and greater. By use of this technique, simultaneous adsorption on six catalyst samples can be carried out, regardless of their individual pretreatment history. Use of this method, in conjunction with an integrator for determination of the areas, enables surface measurement of 12 samples in a 6-hour working period. Adoption of this rapid technique is recommended to research and industrial laboratories.

Mathematical Optimization of Platforming Process

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Based on pertinent kinetic considerations, a mathematical description of platforming process was developed. The analysis takes into account the effects of operating variables, composition of the catalyst, and the type, composition, and boiling