Heterogeneous Catalytic Condensation of Olefins in the Presence of Hydrogen, Using Oxygen as the Reaction Initiator

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Hydrogenation of pentene-1 by hydrogen over a cobalt/clay catalyst at a temperature of 100° results in its condensation to form C_6, C_7, C_8, C_9, and higher hydrocarbons. The yield of the condensed products is about 15%, based on the olefin charge. Addition of oxygen in amounts of 0.7–1.2% increases the product yield by the factor of 1.5–1.7; on the other hand, increasing the reaction temperature to 180°, decreases the yield by 50%.

Oxidation in Gas Phase of Partially Hydrogenated Derivatives of Benzene

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A study of oxidation of 4,5-dimethyl-1,2,3,6-tetrahydrophthalic anhydride, 1,2,4,5-tetramethylcyclohexane, 4-methyl-1,2,3,6-tetrahydrophthalic anhydride, and of 2,6-dimethyldecalin was carried out in the gaseous phase over a vanadium catalyst. The oxidation of 4,5-dimethyl-1,2,3,6-tetrahydrophthalic anhydride and of 1,2,4,5- tetramethylcyclohexane resulted in formation of pyromellitic anhydride in amounts of 35–45% and the oxidation of 2,6-dimethyldecalin produced up to 12% of phthalic anhydride. The processes investigated demonstrate that dehydrogenation of naphthenes and of partially hydrogenated aromatics—to form alkyl benzenes—occurs ahead of the oxidation reaction. A hypothesized mechanism is described for oxidation in the gaseous phase of the subject hydrocarbons.

Valence State of Chromium in Active Centers of a Potassia-Chromia-Alumina Dehydrogenation Catalyst

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The results of this study demonstrate that the active centers, responsible for chemisorption of hydrocarbons on a reduced potassia-chromia-alumina catalyst, contain Cr^{2+} ions.

Decomposition of Isopropyl Alcohol Over Titanium Dioxide With an Octahedral (Anatase) Structure

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Decomposition of isopropyl alcohol was investigated, using octahedral (anatase) TiO_2 and the $TiO_2 + 0.5$ mol % WO_3 catalysts. The added WO_3 has substantially no effect on catalytic properties of octahedral TiO_2. The experimentally-determined catalytic activities, electroconductance, and the electron work function values of the two catalysts are compared with the like performance characteristics of another set of two catalysts of identical composition but using the TiO_2 component with rutile structure.

Chemisorption of Nitrogen on Precipitated Iron Catalysts Used in Ammonia Synthesis

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Chemisorption of nitrogen was studied at a temperature of 475° on the precipitated iron catalysts promoted with Al_2O_3 (1–37.5% by wt), K_2O ($\sim$2%, by wt), and by $Al_2O_3 + K_2O$. The unpromoted iron catalyst is used in commercial production of ammonia.

Addition of individual promoters —particularly, of K_2O— to the precipitated iron catalyst increases its capacity to chemisorb nitrogen; on the other hand, simultaneous addition of the two promoters results in co-inhibition of their individual ability to promote the chemisorption.

The fused and precipitated iron catalysts with near-identical compositions have similar capacities for chemisorption of nitrogen.

Certain discrepancy was found to exist between capacity of the promoted iron catalysts to chemisorb nitrogen and their catalytic activities in the ammonia synthesis at atmospheric pressure.

Phase Analysis of Ferric Oxide-Molybdena Catalysts

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The results show that a 0.3 *M* solution of hydrazine in hydrochloric acid selectively dissolves the trivalent iron molybdate. A method of phase analysis is proposed for the iron-molybdenum catalysts which are composed of Fe_2O_3, $Fe_2(MoO_4)_3$, and MoO_3.

Tables and Graphs for Determination of Optimum Yields of Primary Products in Series—Parallel Reactions

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The author demonstrates that in the series-parallel reactions of the second order the optimum yield of the primary product, $x_{1,m}$, and the corresponding quantity of the unreacted feed, $x_{0,m}$, are defined by the mutually interchangeable functions of the direct ratio, α, of the reaction rate constants, k_2 and k_1 (i.e., $\alpha = k_2/k_1$) and of the corresponding inverse ratio, r (i.e., $r = 1/\alpha$), so that:

$$x_{1,m} = \alpha^{\frac{1}{1-\alpha}} = r^{\frac{1}{1-r}};$$

and

$$x_{0,m} = \alpha^{\frac{1}{1-\alpha}} = r^{\frac{1}{1-r}}$$

The tables of values of $x_{1,m}$ and $x_{0,m}$, corresponding to the listed values of the arguments α and r, are accurate to the fourth decimal place, when the α values (and those of the corresponding r's) are shown to be accurate to the second decimal place. The plots of $x_{1,m}$ and $x_{0,m}$ as functions of α (and, therefore, also of r) are shown for the α values of 0 to 1.

Improved Non-Gradient Reactors Equipped With a Plunger-Type Turboagitator for Study of Kinetics of Heterogeneous Catalytic Reactions

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A novel version of non-gradient reactors equipped with a plunger-type turboagitator is described. This differs in design from that described earlier in that the catalyst-holding chamber in the new version is located in the lower section of the reactor, underneath the plunger of the turboagitator. This alteration in the reactor design makes possible evaluation of performance of physically-weak granular catalysts. The reactor of the earlier design and the improvements proposed in the new version are described in detail and typical dimensions of the reactor components are listed. The cases are cited where the novel reactor could be suitably employed.

A Reactor of Novel Design for EPR Studies of Reactions in Gaseous Phase

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A reaction vessel of novel construction is described for use in EPR investigations of rarefied flames. The vessel of the new design is operable at significantly lower flame pressures and, as a result, produces line spectra with improved resolution characteristics. The special method of heating the reactor ensures production of the flame within the spectrometer resonation zone coincident to registering of the EPR signals, which are due to the magnetic and electronic dipole-dipole induced transitions.

LETTER TO THE EDITOR

EPR Signal Due to $CrCl_3$ on a Carrier

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It is known that with $CrCl_3$ the shape of the narrow EPR line of Lorentzian mode is due to the exchange interaction of the Cr^{+3} ions via the Cl^- ion. To determine if the width and shape of the EPR signal due to small concentrations of $CrCl_3$ in an inert carrier would be identical with that for the "pure" $CrCl_3$, a sample of $CrCl_3$ (2% by wt) on γ-Al_2O_3 support was prepared and analyzed. The method of preparation comprised soaking γ-Al_2O_3 in an aqueous solution of $CrCl_3 \cdot 6H_2O$, followed by drying the soaked material at a room temperature and by subsequent heating in a stream of CCl_4 at a temperature of 350° —to convert the added $CrCl_3 \cdot 6H_2O$ into anhydrous $CrCl_3$.

The EPR spectrum of the supported catalyst — as obtained in Spectrometer RE 13-01 at μ of 9326 M hertz— is a narrow line, with ΔH of $74 \pm 2\,e$ and g of 1.98 ± 0.01. The EPR spectrum of pure $CrCl_3$ has identical parameters. Analysis of the EPR spectrum of the supported $CrCl_3$ by the method of linear anamorphism shows that the line retains Lorentzian shape at its center but assumes Gaussian shape at the extremities. Thus, the analysis shows that the exchange interaction also takes place in the case of the supported $CrCl_3$ — although, due to the effect of the support, the interaction is not as great as with the pure $CrCl_3$.