Non-Gradient Reactors for Investigation of Kinetics of Heterogeneous Catalytic Processes

By G. P. KORNEYCHOOK
L. V. Peesarjevskii Institute of Physical Chemistry of the Academy of Sciences of Ukrainian S.S.R.

Recommend two types of non-gradient reactors with improved heat transfer characteristics: (1) Reactors equipped with piston-type turbolizer, and (2) Reactors equipped with plunger-type recycle pumps. The improvement in heat-transfer attained is due to improved catalyst distribution in the reactor draw-off duct and the more effective arrangement of the reactor within the heat-abstracting media.

Non-Gradient Methods to Study Kinetics of Liquid Phase Heterogeneous Catalytic Processes

By S. L. KEEPERMAN
N. D. Zeleenskii Institute of Organic Chemistry of the Academy of Sciences of U.S.S.R.

Discuss usefulness of non-gradient techniques for study of kinetics of heterogeneous catalytic reactions and for evaluation of catalysts in liquid phase reaction systems.

Recycle-Continuous Technique for Study of Kinetics of High Pressure Heterogeneous Catalytic Reactions

By I. P. SEEDOROV, D. B. KAZARNOVSKAYA AND P. P. ANDREYEECHEV
State Scientific Research Institute for Nitrogen Industry

Give a description of a recycle-continuous system—requiring no mechanical recycling equipment—for evaluation of catalysts and reaction kinetics at high pressures. Recirculation is effected by a thermo-syphon technique.

Recycle-Flow Catalytic Unit

By G. I. LEEVY AND V. E. VASSERBERG
N. D. Zeleenskii Institute of Organic Chemistry of the Academy of Sciences of U.S.S.R.

Describe an improved version of a recycle-flow unit which is suitable for evaluation of catalytic activity at both the near-quasi-static conditions and the recycle-continuous conditions, with simultaneous continuous draw-off of not only the gaseous products but also of the separating heavier reaction products.

Catalysts and Catalytic Reactions in Chromatographic Processes

By S. Z. ROGEENSKII, M. I. YANOVSKII AND G. A. GAZEEYEV
Institute of Chemical Physics of the Academy of Sciences of U.S.S.R.

Describe basic laws governing catalytic reactions in chromatographic processes. Using dehydrogenation of cyclohexane to benzene over a platinum catalyst as an example, show that at specified conditions chromatographic processes are more attractive, giving product yields which are higher than the equilibrium. Present a comparison between the experimental results from a chromatographic unit and from a unit operating at usual dynamic conditions.

Present the results of a radio-chromatographic technique used to study catalyst performance during initial in-service period.

Kinetic Analysis of Chemical Interaction of Gases with Solids in a Fluidized Bed

By A. L. ROSENTAL
The Institute of Petrochemical Synthesis of the Academy of Sciences of U.S.S.R.

Present a method to calculate the kinetics of chemical interaction of gases with solids in a "boiling" bed inside a model reactor. The calculation involves an equation for kinetics of the process as applied to a single particle and the equations to describe the flow of the particles and of the gas in the bed.

Examine possible methods to investigate topochemical and catalytic reactions when the composition of a gas in contact with the particles changes rapidly.

Evaluation of Catalytic Activity in Commercial Fluid Cracking Units Equipped with Catalyst Recycling Systems

By V. S. ALEEYEV, S. A. YEFEEMOVA, A. P. KASEEMOVA AND B. G. TER-SARKEESOV
The Institute for Petrochemical Processes of the Academy of Sciences of Azierbaidjan S.S.R.

Suggest a laboratory method for evaluation of activity of powdered catalysts in fluidized ("boiling") bed cracking of a vaporized reference feed under standardized conditions. Superficial linear velocity of the vaporized feed in the reactor is held at 0.06 m/sec.

For evaluation of a chromia-alumina dehydrogenation catalyst recommend operation with

intensively "boiling" bed. To bring this about, increase the linear gas velocity to 0.15 m/sec and also increase the bed height. In this case, because of departure from the standardized operating conditions, employ a reactor of modified construction.

Laboratory Method of Dehydrogenation of Isopropyl Alcohol Over Weighed Catalyst Bed

By B. V. Yerofeyev and R. I. Beilskaya
The Institute of Organic Physical Chemistry of the Academy of Sciences of Bielo-Russian S.S.R.

Describe a laboratory technique of dehydrogenation of isopropyl alcohol over a weighed bed of catalyst.

Show that lowering of acetone yield, which is observed at various operating conditions, is due to a partial reversal of the reaction over the catalyst in a colder section of the reactor. Entrainment of the catalyst from the weighed bed and subsequent deposition account for its presence in the colder reactor zone. Also show that in absence of such catalyst loss, near-equilibrium yields of acetone are produced to agree with the equation, $CH_3CH(OH)CH_3 \leftrightharpoons CH_3COCH_3 + H_2$.

Standardization and Automation of Some of the Laboratory Steps in Preparation and Evaluation of Catalysts

By V. E. Vasserberg
N. D. Zeleenskii Laboratory of the Institute of Organic Chemistry of the Academy of Sciences of U.S.S.R.

Describe construction of a number of simple laboratory devices, such as an electrolytic burette to measure delivery of liquids, electronic manometers of a variable-resistance type, highly-sensitive spring-beam balances for adsorption measurements, and bench-scale micro-cathetometers. These instruments, along with various standard electronic measuring devices, make possible to automate and standardize some of the laboratory operating steps, such as precipitation of catalysts at constant pH values, recording the amounts of gases separating from liquids, introducing test-specimens into processing units under vacuum and withdrawal of samples therefrom, maintenance of constant gas flow-rates and recording them, etc.

A Thermographic Method for Determination of Natural and Synthetic Silica-Alumina Catalysts

By Z. G. Zoolfoogarov, A. S. Aleeyev, S. M. Rasoolova and V. E. Smeernova
Institute of Chemistry of the Academy of Sciences of Azierbaidjan S.S.R.

Show that activity of silica-alumina cracking catalysts can be evaluated frrom intensity of the thermograms of the primary endothermal effect. Also, demonstrate reversibility of catalytic activity and of the thermogrammic properties of silica-alumina hydrogels.

Methods for Calculating Kinetics of Continuous Heterogeneous Catalytic Processes Retarded by the Reaction Products

By A. Ya. Rosovskii
Institute of Petrochemical Synthesis of the Academy of Sciences of U.S.S.R.

With concentration of a reactant on a catalyst surface as the basis, determined some of the parameters of kinetics of the first order catalytic reactions. The correlation between catalytic activity and the reaction rate constant is the preferred parameter of a heterogeneous catalytic reaction. Activity of a catalyst is most accurately expressed as the amount of a substance reacted per unit of time and per unit quantity of active centers.

Also investigated were kinetics and methods of calculation of the reaction rate constants for the kinetic and the internal diffusion and adsorption stages of the process, as well as the methods to determine the value of the diffusion retarding factor in a differential reactor. Although equations of the same type serve to describe all of the three stages of the process, the values of the equation constants for each stage are different in magnitude and in physical significance. To optimize accuracy of these calculations, extreme care must be exercised in evaluating physical significance of the parameters derived from the experimental data, correcting them, where necessary, for the superimposed distorting effects of diffusion and adsorption.

Evaluation of Catalysts and of Catalytic Processes in Tall Beds

By O. A. Strieltzov, B. P. Samareen, I. P. Seedorov and M. T. Roosov
The State Institute for Nitrogen Industry. L. V. Peesarjevskii Institute of Physical Chemistry of the Academy of Sciences of Ukranian S.S.R.

Review a method to evaluate catalysts and catalytic reactions in tall beds, with concurrent determination of concentrations of the reactants and of the longitudinal bed temperature gradient. This method is applicable to high pressure processes; it is also suitable for accumulation of reliable data to be used in designing commercial-size reactors.