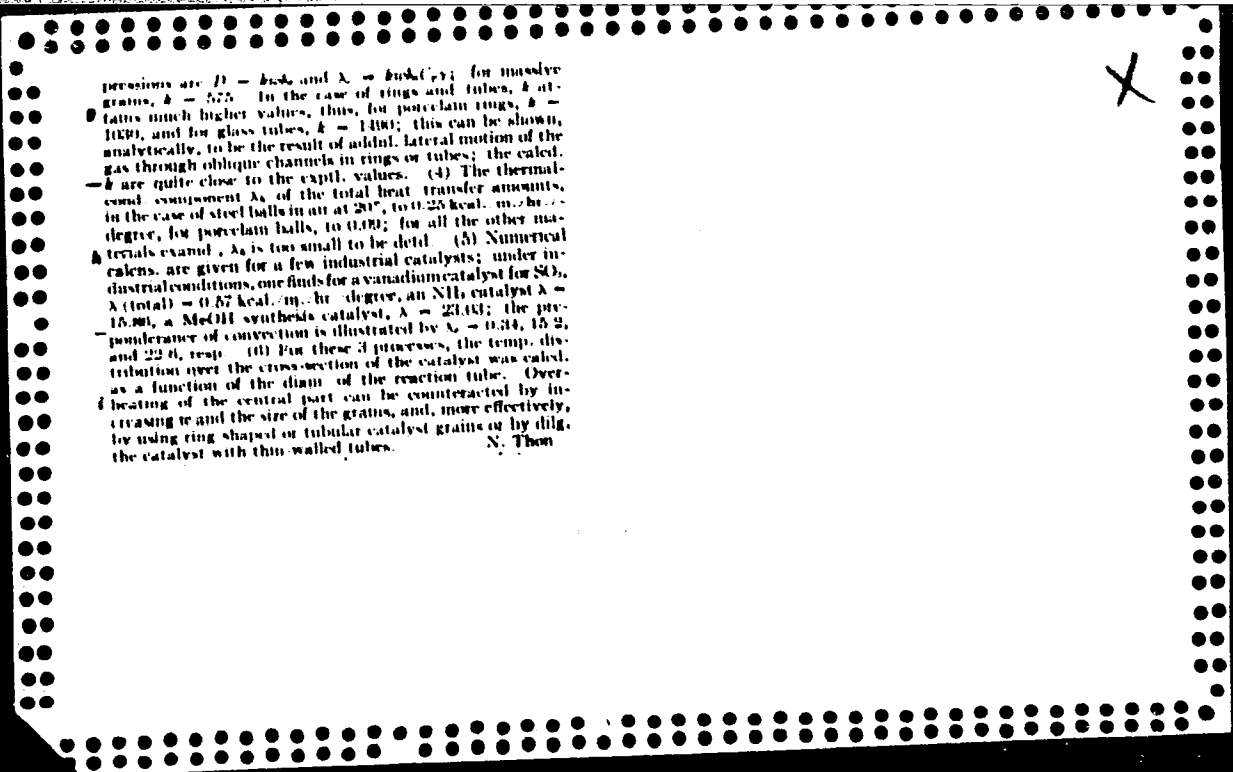BORESKOV,G.K., doktor khimicheskikh nauk

Effect of heat transfer and various substances on the rate of
contact reactions. Khim.prom.no.9:257-263 S'47.   (MLRA 8:12)
(Chemical reaction, Rate of)

The effective coefficient of heat conductivity of contact masses. V. G. Bakhurov and G. K. Boreskov. J. Applied Chem. (U.S.S.R.) 20, 721-38(1947)(in Russian). (1) Heat transfer in layers of granular catalysts, in a direction perpendicular to that of the gas stream, is the sum of the heat transfers due to convection, thermal cond. and radiation. Theoretically, for a model consisting of packed spheres of diam. d, in a stream of gas of sp. wt. γ (kg./cu m.) and heat capacity C_p (kcal.), flowing at the linear velocity u, the effective coeff. of heat convection $\lambda = 0.40 ud C_p\gamma$ (kcal./m./hr./degree). For nonspherical elements and disordered packing the proportionality should still hold, only the numerical factor is different. Similarly, for regularly packed spheres, the effective coeff. of heat cond. proper is found $\lambda_c = 2\pi\lambda_{gr}(\lambda_m/\lambda_e)$ where the subscripts m and g refer to the grain material and the gas, resp., and ϕ is a function which as a first approx., can be identified with the log. The radiative heat transfer is proportional to T^3 (abs. temp.), and, at given T, increases with the diam. of the grains. (2) Expts. were made in a vertical chamber, divided into 2 halves by a vertical partition. Radiative heat transfer was eliminated by the low temp. (35°) of the expts. To det. the convective component, the air stream entering one half of the chamber was tagged with 0.2% SO₂; its spread (in terms of the ratio of the momentary and the initial concn., c/c_0), in the horizontal direction, across the packing was detd. analytically and mapped as a function of the distance x from the partition. The packings used were: Fe filings, steel balls (7.9 × 6 and 13-14.6 mm.), porcelain balls and rings, crushed porcelain, glass rods (diam. 4.5-5.3 mm., length 7.8-16.6 mm.), glass tubes, zeolite pellets, and catalyst grains (diam. 3.7, length 7.7 mm.). The plots of c/c_0 against x are identical (and reversed) for the left and right-hand halves of the app.; the area F enclosed be-

tween the curve and the vertical axis representing the position of the partition, gives the amt. of substance transferred from one half to the other. At const. u transferred from one half to the other. At const. u 0.32 m./sec., increase of the height h of the packing (zeolite pellets) from 140 to 400 mm., corresponding to an increase of the time of contact τ from 0.4 to 1.2 sec., increased F markedly. Threefold variation of u having had no effect on F, and τ being inversely proportional to u (at const. h), it follows that λ_c is directly proportional to u. At const. u and h, variation of the diam. of spherical elements (from 3 to 18.8 mm.) resulted in an increase of F. Under identical conditions, Raschig rings gave the greatest F, then (in the order of decreasing F), spheres, pellets, crushed fragments and filings; for glass tubes, F is considerably greater than for rods. The total coeff. of heat transfer ($\lambda_c + \lambda_s$) was detd. by local temp. measurements ($\pm 0.05°$) from 25 to 25 mm., one vertical half of the chamber receiving a preheated air stream. The shape of the heat-transfer curves is the same as that of the substance transfer, and the variation with τ, the diam. and shape of the packing elements are the same. In most cases the two curves coincide very nearly, except in the case of metallic packing where F for the heat transfer is, at all h, considerably broader. Consequently, except in the case of metallic packings, heat transfer by convection is predominant, and thermal cond. secondary. (3) F is shown analytically to be a certain function of the dimensionless criterion Dr/a^2, where $D =$ effective coeff. of diffusion, $a =$ distance from the partition; hence, from the expt. curves one can det. D and $\lambda_c = DC_p\gamma$. At const. u, these magnitudes are found to be proportional to the "equiv. diam." d_e of the grains, defined as the diam. of spheres of which a no. equal to that of the grains diam. of spheres of which a no. equal to that of the grains of the given material fills the same vol. The general re-

persions are $D = k_0 d$, and $\lambda = k_0 d C_p$; for massive grains, $k = 575$. In the case of rings and tubes, k attains much higher values, thus, for porcelain rings, $k = 1080$, and for glass tubes, $k = 1400$; this can be shown, analytically, to be the result of addnl. lateral motion of the gas through oblique channels in rings or tubes; the calcd. $-k$ are quite close to the exptl. values. (4) The thermal-cond. component λ_s of the total heat transfer amounts, in the case of steel balls in air at 20°, to 0.25 kcal. m./hr./degree, for porcelain balls, to 0.09; for all the other materials examd., λ_s is too small to be detd. (5) Numerical calcns. are given for a few industrial catalysts; under industrial conditions, one finds for a vanadium catalyst for SO_2, λ (total) = 0.57 kcal./m./hr./degree, an NH_3 catalyst $\lambda = 15.80$, a MeOH synthesis catalyst, $\lambda = 23.03$; the preponderance of convection is illustrated by $\lambda_s = 0.34$, 15.2, and 22.0, resp. (6) For these 3 processes, the temp. distribution over the cross-section of the catalyst was calcd. as a function of the diam. of the reaction tube. Overheating of the central part can be counteracted by increasing te and the size of the grains, and, more effectively, by using ring shaped or tubular catalyst grains or by dilg. the catalyst with thin-walled tubes.   N. Thon

BORESKOV, G. K.

PA 68T24

USSR/Chemistry - Silica, Colloidal   May 1948
        Chemistry - Absorption

"Influence of the Conditions of Preparation on the
Structure of Silica Gel," G. K. Boreskov, M. S. Boris-
ova, O. M. Dzhigit, V. A. Dzis'ko, V. P. Dreving, A.
V. Kiselev, O. A. Likhacheva, Moscow State U imeni M.
V. Lomonosov, Phys Chem Inst imeni L. Ya. Karpov,
Moscow, 14 pp

"Zhur Fiz Khim" Vol XXII, No 5

Samples of various types of silica gel (vitreous,
chalky, etc.) obtained by different methods and their
absorbent properties compared. Results are tabulated
and shown graphically. Submitted 14 Aug 1947.

68T24

BORESKOV, G. K.

USSR/Physics
Silica Gels
Temperature

Oct 48

"Effect of the Ignition Temperature on the Structure of Silica Gels," G. K. Boreskov, M. S. Borisova, V. A. Dzis'ko, A. V. Kiselev, O. A. Likhacheva, T. N. Morokhovets, Moscow State U imeni M. V. Lomonosov, Physicochem Inst imeni Karpov, 3 2/3 pp

"Dok Ak Nauk SSSR" Vol LXII, No 5

Three types of silica gel prepared: (1) glasslike samples with fine pores, (2) glasslike samples with uniformly coarse pores, and (3) chalklike samples of mixed porosity. Tests of adsorption and —

PA 53/49T99

53/49T99

USSR/Physics   (Contd)   Oct 48

desorption of methyl alcohol vapors yielded isotherms showing that 12-hour periods of ignition temperatures from 115 to 1,000 C affected samples' adsorption properties differently. Fine-pore glasslike samples were least-stable thermally. Chalklike samples showed highest stability. Submitted by Acad M. M. Dubinin, 11 Aug 48.

53/49T99

Brit. Abs.

BI- 8 Acids, alkali, Salts.

Temperature of vanadium catalysts for sulphuric acid manufacture. G. K. Boreskov, L. G. Ritter, and E. I. Volkova (*J. appl. Chem. U.S.S.R.*, 1949, **22**, 290—300).—The industrial value of catalysts for exothermic reactions is determined partly by the min. temp. of the incoming gas necessary for rapid attainment of optimum conditions. In experiments with V_2O_5 catalysts for H_2SO_4 manufacture from SO_2 and O_2 mixtures this temp. was chosen as that at which the catalytic reaction produced a 10° rise in the temp. of the catalyst. With constant O_2 content the heating temp. scarcely changed with variations in the SO_2 content, but with increase of O_2 content the temp. fell. Experimental values of the change of temp. with gas composition agreed with values calculated theoretically. The catalytic oxidation of SO_2 takes place entirely on the surface of the catalyst.
                                                                    S. G. SMITH.

Lab. of Catalysis, Sci. Res. Inst. Fertilizers + Insectofungicides

Porosity and activity of catalysts. I. Hydrolysis of chlorobenzene on silica gels of various structures. G. K. Boreskov and V. A. Dzis'ko (Karpov Phys.-Chem. Inst., Moscow). Zhur. Fiz. Khim. 34, 1135-46(1960).—The relation between catalytic activity and catalyst porosity was studied on various samples of silica gel with the following characteristics (wt. of unit vol. of catalyst, pore vol., sp. surface area, av. pore radii): (I) 0.83 g./cc., 0.31 cc./g., 640 sq. m./g., 10 Å.; (II) 0.64 g./cc., 0.51 cc./g., 350 sq. m./g., 15-20 Å.; (III) 0.49 g./cc., 0.8 cc./g., 400 sq. m./g., 35-40 Å. The prepn. of the catalysts was described previously (C.A. 42, 7132d.) The kinetics was studied in a flow system. The pressure was maintained const. between 100 and 150 mm. Before each run, lasting 4-6 hrs., fresh catalyst was used. PhOH and HCl were sampled and titrated at 20-min. intervals. All catalysts lose their activity more or less rapidly; this deactivation is more pronounced the higher the temp. or the finer the pores. Since all catalysts were preheated at temps. higher than the ones prevailing during the reaction, the activity decrease was due to stopping of the pores by carbonaceous material. The kinetic law is found by changing the concn. c of PhCl between 0.9 and 14%. H_2O is present in excess. There is a linear relation between log c and the contact time t. The slope of the straight lines is 0.5 so that either $-dc/dt = k_1 c^{0.5}$ or $-dc/dt = k_2/c^{0.5}$, where c_i is the product concn. Since k_1 is more nearly const. than k_2 for c between 13 and 15%, the 1st law is preferred for the calcn. For all catalysts, the Arrhenius plot (log k_1, $1/T$) consists of 2 straight lines. The break in the Arrhenius line occurs, however, at different temps. for dif-

ferent catalysts, viz., 525° for I, 560° for II, and 585° for III. At these temps. the activation energy E (in kcal.) changes from 50.6 to 17.0 (I), from 49.7 to 24.3 (II), and from 50.9 to 36.2 (III). The higher E corresponds to the kinetic range, the lower E to the diffusion range. The activity per unit surface is the same for all catalysts in the kinetic range but varies from catalyst to catalyst in the diffusion range owing to different pore structures. In the latter range, the internal surface is less fully utilized and this effect is more pronounced for catalysts with finer pores. A coeff. of utilization of the internal surface is calcd. for the 3 catalysts on the assumption that diffusion into the pores is the rate-detg. step at high temp. The activity per unit surface can be thus calcd. for various temps. in the diffusion range. The good agreement with the observed values substantiates the role attributed to the porous structure of a catalyst. Michel Boudart

Magyar Kemia i Folyoirat
Hungarian Journal of Cnomistry
vol. 57 1951
nol   January
       G. K. Boreskov, M. S. Borisova,
       O. N. Drigit, V. A. Dzisko,
       V. P. Dreving, A. V. Kiselyev
       and O. A. Lihaceva:
          The influence of the conditions of prepa-
          ration on the structure of silica gel
          (From the Russian) .... 16 - 23

          Discussions during the fest week of
          the Hungarian Academy of Sciences .... 24 - 32

ASA-SLA   METALLURGICAL LITERATURE CLASSIFICATION

MALIN, K. M., ARKIN, N. L., BORESKOV, G. K. SLIN'KO, M. G.

Sulfuric Acid

"Production of sulfuric acid." Reviewed by D. A. Yepshteyn, Zhur.prikl.khim. 25 No. 4, 1952

9. Monthly List of Russian Accessions, Library of Congress, ___August___ 1953, Uncl.

BORESKOV, G. K.

USSR/Chemistry - Catalysts; Reaction   Feb 52
          Kinetics

"Kinetics of Reversible Catalytic Reactions in the
Range of Internal Diffusion," G. K. Boreskov, M. G.
Slin'ko, Phys Chem Inst imeni L. Ya. Karpov, Moscow

"Zhur Fiz Khim" Vol XXVI, No 2, pp 235-238

Observed rate of exothermic reversible reaction in
the range of int diffusion cannot be expressed in
its general form as a difference between rates of
direct and reverse reactions. The concepts of
observed energy of activation for direct and

reverse reaction are devoid of meaning in the range
of int diffusion. Optimal temps for reversible
reactions in the range of int diffusion depend on
the form of the kinetic eq. They are lower than
the corresponding temps in the kinetic range.

211T48

211T48

USSR/Chemistry - Catalysts   Apr 52

BORESKOV, G. K.

"The Effect of Heat Treatment on the Structure and Catalytic Activity of Aluminum Oxide." G. K. Boreskov, V. A. Dzis'ko, M. S. Borisova, V. N. Krasnopol'skaya, Phys Chem Inst imeni L. Ya. Karpov, Moscow

"Zhur Fiz Khim" Vol XXVI, No 4, pp 492-499

(1)

Heating for 24 hrs at temps up to 600° does not change the surface and porosity of samples in comparison with those treated at 450°. At higher temps there are reduction of surface and changes of pore structure involving formation of larger pores.

21T123

(2)

The surface reduction proceeds much more rapidly than the decrease in pore vol. Samples of different initial pore structure exhibit different resistance to high temps, those with the finest pore structure being the most strongly affected. Although the total catalytic activity is lowered as a result of heat treatment, the specific activity (activity per unit of surface) is increased to some extent if the temp of treatment is below 1,200°. The reason is the effect exerted on int diffusion. The activity of a sample heat-treated at 1,000° is increased, because fine pores the surface of which remains unused in catalysis

21T123

(3)

disappear at 1,000°. This does not happen at lower temps. The specific activity of gamma-Al₂O₃ is not affected by the temp of heat treatment and does not depend on crystal size; only transformation into alpha-Al₂O₃ changes the nature of the surface. The data on catalytic activity are based on the reaction of ethyl alc dehydration.

21T123

BORESKOV, G. K.

256T9

USSR/Chemistry - Catalysts   11 Jul 52

"The Specific Catalytic Activity of Metallic
Platinum," V.S. Chesalova and G.K. Boreskov

DAN SSSR, Vol 85, No 2, pp 377-379

The quality of the surface of Pt, from the stand-
point of catalytic activity in respect to the re-
action of SO_2 oxidation, does not undergo great
changes as a result of variations in the condi-
tions of prepn of the catalyst, the types of
carrier used, and differences in the specific
surface, size of crystals, and mech and thermal

256T9

treatment. The principal factor detg catalytic
activity is the magnitude of the specific sur-
face available for the components of the re-
action. Presented by Acad M.M. Dubinin
9 May 52.

1. BORESKOV, G. K., KARNAUKHOV, A. P.

2. USSR (600)

4. Catalysts

7. Adsorption method used for measuring the platinum surface in plantinized silica gels, Zhur. fiz, khim. 26, no. 12, 1953.

9. **Monthly List of Russian Accessions**, Library of Congress,   May   1953, Unclassified.

BORESKOV, G. K.

USSR/Chemistry - Platinized Silica Gel   May 53

"Some Observations on G.K. Boreskov and A.P. Kar-
naukhov's Article on 'The Measurement of the Sur-
faces of Platinized Silica Gels'," N.I. Kobozev,
Moscow State Univ

Zhur Fiz Khim, Vol 27, No 5, pp 761-764

Criticizes work by Boreskov and Karnaukhov, who
proposed a method for detg the surface of Pt de-
posited in the form of dispersed adsorption films,
by measuring the adsorption of H₂. States that
Boreskov and Karnaukov stress crystallization, while
there is actually marked atomization of Pt in the
films in accordance with the theory of active
ensembles.

273T19

BORESKOV, G.K.

USSR/Chemistry - Catalysts

May 53

"The Question of the Surface of the Promoter Deposited on the Carrier, "R.Kh.Burshteyn, Inst of Phys Chem, Moscow, Acad Sci USSR

Zhur Fiz Khim, Vol 27, No 5, P 765

The author refers to work by G. K. Boreskov and A.P. Karnaukhov criticising procedure for detn of the surface of Pt on C acc to method developed by the author himself (R. Kh. Burshteyn), P.I. Levin, and S.M. Petrov. States that Boreskov and Karnaukhov, utilizing data based on detn of the surface on Pt on silica gel, concluded that the author erred by 15% in detg the surface of Pt on C. Adds that data which apply to silica gel do not necessarily apply to carbon.

Effect of sodium hydroxide on the catalytic activity of
aluminum oxide in relation to the decomposition of ethyl
alcohol. G. K. Boreskov, V. A. Dzis'ko, and M. S. Bori-
sova (L. Ya. Karpov Phys.-Chem. Inst., Moscow). Zhur.
Fiz. Khim. 27, 1172-5(1953); cf. C.A. 42, 21h.—The
progressive poisoning of Al_2O_3 catalysts by NaOH was in-
vestigated. Samples of Al_2O_3 prepd. in 4 different ways
were made to absorb various amts. of NaOH from soln.,
then dried and kept 1 hr. at 450°. The catalytic activity
of each sample was detd. from the amt. of C_2H_4 produced
when EtOH was passed over it at 420°. The total adsorp-
tion surface was detd. by means of a sorption balance with
MeOH as the adsorbate. Sp. gr., vol. of micropores in
cc./g., total surface in sq. m./g. and sq. m./cc., and total
and specific catalytic activities of each of the initial samples
are tabulated. The rate const. for the formation of C_2H_4
is shown graphically as a function of the amt. of adsorbed
NaOH in millimoles/g. for each type of sample. The rela-
tive rate consts. are plotted as functions of the no. of milli-
moles of adsorbed NaOH per sq. cm. of adsorbing surface.
The pore size and total surface of Al_2O_3 are unchanged by the
NaOH treatment. The catalytic activity decreases as the
amt. of adsorbed NaOH increases, most rapidly for the
smallest amts. of NaOH. This probably corresponds to
adsorption of NaOH mols. on active groups of the surface.
It is concluded that the active regions comprise 5-10% of the
total surface of the Al_2O_3 samples. The no. of active
centers per unit surface depends on the purity of the sample
and not on the manner of its prepn.   J. W. L., Jr.

Chemical Abstracts
May 25, 1954
General and Physical
Chemistry

Effect of ignition temperature on the extent of surface and on the water content of the oxides of aluminum and magnesium. G. K. Boreskov, V. A. Dzis'ko, and M. S. Borisova (L. Ya. Karpov Phys.-Chem. Inst., Moscow). Zhur. Fiz. Khim. 27, 1176-80(1953); cf. C.A. 47, 9576h.—In an investigation of the mechanism of catalysis in oxides the water content of Al_2O_3 and MgO was detd. The temp. of a sample of Al_2O_3 in vacuum was raised from 100 to 1200° during a 100-hr. period. The evolved H_2O was weighed by means of a sorption balance. The Al_2O_3 contained 17, 4.5, 1.1, and 0% H_2O at 20, 200, 600, and 1200°, resp. The surface was 245, 235, 127, and 10.5 sq. m. per g. at 450, 800, 1000, and 1200°, resp. On similar treatment $Mg(OH)_2$ was entirely converted to MgO below 370°; the rate of conversion was max. at 290°. The H_2O content and the surface of MgO at 400, 700, and 1000° were 2.9, 0.38, and 0.01%, resp., and 347, 86, and 11 sq. m. per g., resp. In both oxides the water appears to be held in solid soln. above 400°. Exptl. data are tabulated and graphed.   J. W. L., Jr.

BORESKOV, G. K.

USSR/Chemistry - Catalysts; Sulfuric Acid   1 Sep 53

"Catalytic Activity of Metals and of Platinum-Gold Alloys in Respect to the Oxidation of Sulfur Dioxide," G. K. Boreskov, M. G. Slin'ko, and Ye. I. Volkova

DAN SSSR, Vol 92, No 1, pp 109, 110

Studied the catalytic activity of Cr, Rh, Pd, Ag, W, Pt, Au, and of an alloy consisting of 5% Au and 95% Pt on the oxidation of SO_2. Most of the above metals had a low activity due to their instability under the conditions of the reaction. At $560°$ Pt is more active than Au, but the Pt-Au alloy has a low activity. Refutes the conclusions of D. A. Dowden, Chem Soc, Issue 1, 245, 1950. Presented by Acad M. M. Dubinin 3 Jul 53.

274T12

Boreskov, G. K.

B. T. R.
Vol. 3 No. 4
Apr. 1954
Chemistry-Physical

5
(3) Chem

4630*   Catalytic Activity of Nickel, Palladium, and Plati-
num With Respect to Reaction of Hydrogen Oxidation.
(Russian.) G. K. Boreskov, M. G. Slin'ko, and A. G. Filip-
pova. Doklady Akademii Nauk SSSR, v. 92, no. 2, Sept. 11,
1953, p. 353-355.
Specific activity was determined. Diagram, table. 2 ref.

7-28-54

BORESKOV, G.K.

The Committee on Stalin Prizes (of the Council of Ministers USSR) in the fields of science and inventions announces that the following scientific works, popular scientific books, and textbooks have been submitted for competition for Stalin Prizes for the years 1952 and 1953. (Sovetskaya Kultura, Moscow, No. 22-40, 20 Feb - 3 Apr 1954)

Name	Title of Work	Nominated by
Malin, K.M.	"Technology of Sulfuric	Ministry of the Chemical
Boreskov, G.K.	Acid" (student manual)	Industry
Slin'ko, M.G.		
Arkin, N.L.		

SO: W-30604, 7 July 1954

BoReSKov, G. K.

USSR/Chemistry - Reaction

Card 1/1 Pub. 151 - 4/36

Authors   : Boreskov, G. K.; Illarionov, V. V.; Ozerov, R. P.; and Kil'disheva, E. V.

Title   : Chemical reactions in V_2O_5-K_2SO_4 and V_2O_5-$K_2S_2O_7$ systems

Periodical : Zhur. ob. khim. 24/1, 23-29, Jan 1954

Abstract   : Thermographic and x-ray investigations of V_2O_5-K_2SO_4 and V_2O_5-$K_2S_2O_7$ systems
              were carried out to determine their reaction characteristics. The formation,
              in the first of the two systems, of a compound close in its composition to
              $V_2O_5 \cdot K_2SO_4$ with a melting point of about 500° was discovered. The eutectic
              point between this compound and K_2SO_4 was established at below 430° which
              corresponds to an approximate V_2O_5 content of 0.4 mol/fractions. The fusions
              with larger pyrosulfate contents in the second of the investigated systems
              were found to have low melting points and easily convert into glass when sub-
              jected to cooling. An exothermal effect during the heating of this system
              was observed at 275° and this is explained by the formation of a $V_2O_5 \cdot$
              $K_2S_2O_7$ compound. Eleven references: 3-USSR; 4-German; 2-Italian and 1-
              Scandinavian (1905-1950). Tables; graphs. Also 1-English reference.
Institution : Scientific Institute of Fertilizers and Insecticides
Submitted   : May 26, 1953

BORESKOV, G. K.

USSR/Chemistry - Decomposition

Card 1/1

Authors   : Boreskov, G. K., Dzis'ko, V. A., and Yasevich, N. P.

Title   : Effect of the composition of alumo-silicic catalysts on their activity
                 in the process of ethyl alcohol decomposition

Periodical   : Zhur. Fiz. Khim., 28, Ed. 5, 837 - 842, May 1954

Abstract   : Experiments were conducted to determine the effect of the composition of
                 alumo-silicic catalysts on their activity and selectivity in the process
                 of ethyl alcohol decomposition. The activity relative to one aluminum
                 atom on the surface is approximately the same for all investigated samples
                 and does not depend upon the Al_2O_3 concentration in the catalyst. Results
                 also indicate that the relation between the activity and composition of
                 alumosilicic catalysts during the dehydration of the alcohol is entirely
                 different from the relation existing during cracking, isomerization and
                 other hydrocarbon conversion processes. Nine references: 5-USSR, 3-English
                 and 1-USA. Tables, graphs, drawings.

Institution   : The L. Ya. Karpov Physico-Chemical Institute, Moscow

Submitted   : Aug. 18, 1953

BORESKOV G. K.

USSR/ Chemistry   Physical chemistry

Card   : 1/1

Authors   : Boreskov, G. K., Dzis'ko, V. A., and Borisova, M. S.

Title   : Porous structure of catalysts and its effect on their reaction
                selectivity

Periodical   : Zhur. fiz. khim. 28, Ed. 6, 1055 - 1066, June 1954

Abstract   : Two cases of series reactions of the first order were investigated to
                determine the effect of porous structure of catalysts on their reaction
                selectivity. The rate of diffusion transfer, toward the internal
                surface of the catalyst grains and its effect on reaction selectivity,
                was also considered. The selectivity dependence upon the rate of
                diffusion was determined by criteria expressing the relation between
                the rate of chemical conversion and diffusion transfer for the basic
                substance and intermediate product. Four USSR references. Graphs.

Institution : The L. Ya. Karpov Physico-Chemical Institute, Moscow

Submitted   : August 18, 1953

BORESKOV, G. K.

The catalytic activity of the metals of the IV series with respect to the interaction of hydrogen and oxygen. G. K. Boreskov, M. G. Slin'ko, A. G. Filippova, and R. N. Gur'yanova. *Doklady Akad. Nauk S.S.S.R.* 94, 713-15 (1954); cf. *C.A.* 49, 4907e.—The catalytic activity of Ti, V, Cr, Mn, Ni, Co, Cu, and Zn on the interaction of H and O was studied by the method previously described (*loc. cit.*), which permits a direct detn. of the reaction rate at constant temp. along a layer of the catalyst and continuous observations of the nature of changes of catalyst activity. A large excess of H was used in the tests to prevent the oxidation of the catalyst. The catalyst activity was measured at 302, 254, 218, 180, and 135°, under conditions which minimize the diffusion effects. The sp. catalyst activity was expressed as the no. of ml. of (2H₂+O₂) reacting per hr. on 1 sq. cm. of the catalyst surface. The curve of activities passes through a sharp max. at Ni. W. M. S.

BORESKOV, G. K.

LUR'YE,G.E., redaktor; BORESKOV,G.K., redaktor; NABEREZHNYKH,M.Ye., redaktor; PSHEZHETSKIY,S.Ya., redaktor; SLIN'KO,M.G., redaktor; TEMKIN,M.I., redaktor; CHEREDNICHENKO,V.M., redaktor; SHPAK,Ye.G., tekhnicheskiy redaktor

[Heterogeneous catalysis in the chemical industry; papers from the All-Union Conference, 1953] Geterogennyi kataliz v khimicheskoi promyshlennosti; materialy Vsesoiuznogo soveshchaniia 1953 goda. Moskva, Gos. nauchno-tekhn. izd-vo khim. lit-ry, 1955. 494 p.
(MLRA 9:2)

1. Russia (1923- U.S.S.R.) Ministerstvo khimicheskoy promyshlen-
nosti.   (Catalysis)

BORESKOV, G. K. and K. I. MATVEYEV. (Phys.-Chem. Institute im. L. Ya. Karpov).
VLIYANIYE SPOSOBOV PRIGOTOVLENIYA NA KATALITICHESKUYU AKTIVNOST' I PROVODIMOST'
OKISI TSINKA (Effect of the methods of preparation on the catalytic activity
and conductivity of ZnO). In Problemy kinetiki i kataliza (Problems of Kinetics
and Catalysis), vol. 8. Izdatel'stvo Akademii Nauk SSSR, 1955. Section III:
Connection between the electric conductivity and catalytic activity of semi-
conductors. p. 165-174.

Four samples of Sno prepared by different methods (the description of which is
given) were compared concerning their effect on the decomposition of methyl
alcohol. The reactions were carried out at 20 - 325°C; minimum circulation
rate of the gas was 400 l/hr. Thevaluses for the specific activities and
activation energies for all four samples were very close. A detailed descrip-
tion of the determination of the electric conductivity fo ZnO tablets is given.

The data on the specific catalytic activity of the ZnO samples are compliedin
Table i (p. 167). An apparatus for measuring the electric conductivity is
shown in Fig. 3 (p. 169). Characteristics of the electron structure of the
zonc oxide samples are given in Table 2 (p. 171). Changes in the electron
structure and in the specific activity of the catalysts after reduction are
shown in Table 3 (p. 173).

1/2

MATVEYEV, K. I. and G. K. BORESKOV. Vliyaniye ....   AID 820 - S

the conductivities of the initial samples differed greatly. Heating of the samples in vacuo and treatment with vapors of methyl alcohol caused irreversible increase of the conductivity and of the catalytic activity of the samples (in some cases, 160 times of the original value). Twelve references, 5 Russian (1939-1953).

2/2

AF701597   TREASURE ISLAND BOOK REVIEW   AID 835 - 3

BORESKOV, G. K. (Physical Chemistry Institute im. L. Ia. Karpov)
     DISKUSSIYA (Discussion). In Problemy kinetiki i kataliza (Problems of
Kinetics and Catalysis), vol. 8. Izdatel'stvo Akademii Nauk SSSR, 1955.
Section IV. Nature of the active surface. p. 234.

A brief review of the papers presented by F. F. Vol'kenshteyn and V. L.
Bonch-Bruyevich. Boreskov states that the catalyst is more affected by the
action of the reactants than by the nonuniformity of the surface. This is
illustrated by data on the catalytic activity of various ZnO samples used
in the decomposition of methyl alcohol. The initial differences in the
electronic structure of the ZnO samples prepared by different methods
become less important in comparision with changes resulting from the action
of methyl alcohol vapors on the catalyst.

1/1

BORESKOV, G.K.
USSR/Chemistry - Catalysis

FD-1729

Card 1/1   : Pub. 50-5/18

Authors   : Prof. Boreskov, G. K., Dr Chem Sci; Slin'ko, M. G., Cand Chem Sci

Title   : Experimental methods of determining catalytic activity

Periodical : Khim. prom., No 1, 19-26, Jan-Feb 1955

Abstract   : On comparing the static methods, dynamic circulation methods, and
               stationary circulation methods for the laboratroy testing of catalysts,
               arrive at the conclusion that the stationary circulation methods are
               the most reliable. Point out that stationary circulation methods cannot
               be easily applied to the testing of catalysts on a large scale and should
               be replaced by simpler, although less exact circulation methods for that
               purpose. Describe all of these methods and the diaphragm method. Six
               figures. Twenty nine references; 25 USSR, 23 since 1940.

BORESKOV, G.K.
USSR/Chemistry - Sulfuric acid   FD-2524

Card 1/1   Pub. 50 - 3/14

Author   : Prof. Boreskov, G. K., Dr Tech Sci

Title   : The theoretical basis for increasing the efficiency of the
               contact process for sulfuric acid production

Periodical : Khim. prom. No 4, 202-209, Jun 1955

Abstract   : On the basis of data cited and of theoretical relationships used in
               the treatment of the subject, arrives at the conclusions that the
               principal factor in improving the output of sulfuric acid contact
               process installations must be reduction of the resistance to gas
               flow; that the ultimate degree of conversion should not exceed
               97.5-98%; and that the optimum concentrations of sulfur dioxide
               are 7-7.5% in the case of pyrite and 9% in the case of sulfur.
               Discusses conditions which obtain when vanadium catalysts are used.
               Six graphs; 5 tables.

BORESKOU, G.K.

USSR/Chemistry - Book review

Card 1/1   Pub. 147 - 25/26

Authors   :   Nikolayev, L. A.

Title   :   Critique and Bibliography. The book by G. K. Boreskov, Catalysis
                 in sulfuric acid manufacture

Periodical   :   Zhur. fiz. khim. 29/1, 203-204, Jan 1955

Abstract   :   Critical review is presented of the book by G. K. Boreskov entitled
                 "Catalysis in the Manufacture of Sulfuric Acid", published in 1954.

Institution :   ....

Submitted   :   September 28, 1954

Boreskov, G, K,

USSR

/3254

ISOTOPIC EXCHANGE OF MANGANESE DIOXIDE WITH OXYGEN AND WATER VAPOR. L. A. Kasatkina and G. K. Boreskov (Mendeleev Chemico-Technological Inst., Moscow) Zhur. Fiz Khim. 29, 455-62(1955) Mar. (in Russian)

Isotopic exchange was measured by variations in O^{18} concentration between active MnO_2 and O_2 at 300 to 350°C active MnO_2 and water vapor at 200 to 300°C, and β-MnO_2 and O_2 at 350 to 400°C. (G.Y.)

BORESKOV, G. K.

USSR/ Chemistry - Catalysts

Card 1/1   Pub. 147 - 17/22

Authors   : Boreskov, G. K.

Title   : Size of the surface and the catalytic activity of Pt applied on silica gel

Periodical : Zhur. fiz. khim. 29/11, 2086-2089, Nov 1955

Abstract   : Discussion was held on the subject of how to determine the size of the sur-
              face of a solid substance and its catalytic activity when applied on another
              catalytic carrier. Measuring the hydrogen adsorption at 250° the author
              determined the surface of Pt applied on a silica gel catalytic carrier. The
              hydrogen adsorption on the silica gel at this temperature was found to be
              comparatively low and was calculated with sufficient accuracy. The amount
              of hydrogen adsorbed per unit of Pt surface was established by measuring
              the hydrogen adsorption on porous Pt the surface of which was accurately
              determined by the low temperature adsorption of Argon. Six USSR references
              (1950-1953).

Institution : Physicochemical Institute im. L. Ya. Karpov, Moscow

Submitted   : March 3, 1955

Boreskov, G. K.

5

The specific catalytic activity of the metals of the fourth

W. M. ...

Boreskov, G.K.

10632* Catalytic Purification of Gases of Oxygen Admixtures. Kataliticheskaia ochistka gasov ot primesi kisloroda. (Russion.) G. K. Boreskov and M. G. Slinko. Khimicheskaia Promyshlennost, 1956, no. 2, Mar. 1956, p. 69-77. Catalysts and kinetic relationships; methods of calculating devices and technological processes involved in the removal of O from gases by catalytic hydrogenation. Graphs, tables, diagrams. 10 ref.

1. Fiziko-Khimicheskij Inst. Im. L. Ya. Karpova. (Gases) (Oxygen) (Catalysts)

BORESKOV, G.K.

Surface area and catalytic activity of platinum deposited on silica
gel; remarks concerning the reply of N.I. Kobozev. Zhur.fiz.khim.
30 no.3:704-705 Mr '56.   (MLRA 9:8)

1. Fiziko-khimicheskiy institut imeni L.Ya. Karpova, Moskva.
        (Catalysts, Platinum) (Adsorption)

USSR/Physical Chemistry, Kinetics, Combustion, Explosions,
    Topochemistry, Catalysis.   B-9

Abs Jour : Ref Zhur - Khimiya, No 7, 1957, 22438.

Author   : E. V. Gerburt-Geybovich, G. K. Boreskov.
Inst   : Not given
Title   : The temperature dependence of the sulfur dioxide oxidation
           rate on vanadium catalyzers.

Orig Pub : Zh. fiz. Khimii. 1956, 30, No 8, 1801-1801. (res. angl.).

Abstract : Temperature dependence of SO_2 oxidation rate on a non-porous
           activated vanadium catalyzer (K) at 380-520° is studied in a
           gaseous mixture containing 5.3% SO_2 and 19.9% O_2. A break was
           discovered on the curve lg K- I/T at ~475°. As the influence
           of an internal diffusion on K is excluded, so in this case the
           break cannot be explained as a result of a transition to an in-
           ternal-diffusion area. The break of the temperature depends
           upon the contents of the reaction mixture and diminishes from
           475 to 440° with the growth of the initial contact extent
           from 30 to 75%. The break temperature is almost identical with
           the reduction temperature of the active component K, which al-
           so diminishes with an increase in the initial transformation

Card 1/2   -147-

Inst. Fertilizers and Insectofungicides

USSR/Physical Chemistry, Kinetics, Combustion, Explosions,   B-9
    Topochemistry, Catalysis.

Abs Jour : Ref Zhur - Khimiya, No 7, 1957, 22438.

           percentage. This brought the authors to the conclusion that
           the formation of the break on the diagram lg K- IT is related
           with the chemical transformation of an active catalytic com-
           ponent K at low temperatures into an inactive vanadyl sulfate
           $VOSO_4$. The values of SO_2 oxidation rate constants are made
           more precise on K under 460° and optimum temperatures of the
           process realization are obtained at transformation extents >
           97%. Conclusion is drawn that in order to obtain a transfor-
           mation percentage > 97 it is expedient to diminish the tem-
           perature in the last gas K layers to under 440°.

Card 2/2   -148-

BORESKOV, G. K.

The specific catalytic activity of metals. I. Sulfur dioxide oxidation on platinum catalysts. V. S. Chesalova and G. K. Boreskov (L. Ya. Karpov Phys.-Chem. Inst., Moscow). *Zhur. Fiz. Khim.* **30**, 2560-7 (1956).—The detn. of specific catalytic activity of massive Pt wire, foil, and screen, spongy Pt and platinized SiO_2 gel in the SO_2 oxidation showed that the specific activity of all the catalysts was almost the same when referred to a unit of Pt surface, and was affected only slightly by the size of the Pt crystal, or the temp. of the preliminary heat-treatment. The catalytic activity of platinized SiO_2 gel at concns. of 0.001-0.5 wt. % is proportional to the unit wt. of Pt in the catalyst. The size of Pt crystals on the SiO_2 gel is therefore independent of the Pt concn. and depends only on the porosity of the gel structure and the temp. of the preliminary heat-treatment. The activation energy of the SO_2 oxidation reaction on massive Pt and platinized SiO_2 gel is about 23 kcal./mol.

W. M. Sternberg

BORESKOV, G. A.

27

The specific catalytic activity of platinum. G. K. Boreskov, M. G. Slin'ko, and V. S. Chesalova (I. Ya. Karpov Phys.-Chem. Inst., Moscow). *Zhur. Fiz. Khim* 30, 278/93(1956); cf. C.A. 51, 9276/—Pt wire, foil, and platinized SiO_2 gel (0.2% Pt) were used as catalysts at 50-100° in the $2H_2 + O_2$ reaction. The reaction velocity at high H_2 concn. in the gas phase was directly proportional to the O_2 concn. The Pt catalytic activity was affected by its preliminary heat-treatment. Heating in H_2 at 500° increases the initial catalytic activity, which later drops to a const. value. Heating in air lowers the activity to below the stationary value, and the activity gradually rises in use. The changes are apparently connected with the O sorption. The specific catalytic activity of Pt referred to unit surface is nearly alike regardless of the actual differences in the active surface (20.9, 6.9, and 3×10^3 sq. cm./g. in wire, foil, and on SiO_2 gel, resp.). W. M. Sternberg

BORESKOV, G. K. (Prof.)

"Some Questions of Catalyst Selection."

report presented at Scientific Conference at the Inst. for Physical Chemistry imeni L. Ya. Karpov, Acad. Sci. USSR, Nov 1957.

AVDEYENKO, M. A., BORESKOV, G. K., SLIN'KO, M. G.

"Catalytic Activity of Metals in Relation to the Homomolecular Isotopic Exchange of Hydrogen,"

Problemy Kinetics and Catalysis, v. 9, Isotopes in Catalysis, Moscow, Izd-vo AN SSSR, 1957, 442p.

Most of the papers in this collection were presented at the Conf on Isotopes in Catalysis which took place in Moscow, Mar 31- Apr 5, 1956.

BORESKOV, G.K., doktor khim.nauk, prof.; SLIN'KO, M.G., kand.khim.nauk.

Applying the fluidized bed method to heterogeneous catalysis processes. Khim.prom. no.6:321-330 S '57.   (MIRA 11:1)

1.Fiziko-khimicheskiy institut imeni L.Ya. Karpova.
          (Catalysis) (Fluidization)

$BORESKOV, G.K.$

AVDEYENKO, M.A.; BORESKOV, G.K.; SLIN'KO, M.G.

Catalytic activity of metals in respect to homomolecular isotopic
exchange of hydrogen. Probl. kin. i kat. 9:61-75 '57.   (MIRA 11:3)
                    (Catalysis)   (Radioactive tracers)

BORESKOV, G.K.

Discussion. Probl. kin. i kat. 9:92 '57.   (MIRA 11:3)
                    (Catalysts)

The specific catalytic activity of metals. G. K. Boreskov (L. Ya. Karpov Phys.-Chem. Inst., Moscow). _____ _____ _____ _____ _____ _____ _____—The simplest catalytic reactions over metallic catalysts, the isotope exchange of mols. of D_2, the H_2 oxidation, and the NH_3 synthesis from H_2 and N_2 were investigated. The specific metallic activity was expressed in terms of the reaction velocity per unit catalyst surface. The sp. catalytic activity of metallic catalysts prepd. in different ways was of the same order, and chem. compn. of the catalyst was concluded to be the factor that dets. the activity. In the isotope exchange reaction the activity of the elements in the long series of the periodic system increases with the at. no., reaches a max. with the last member of the 8th group, and drops sharply with the metals of Group IB. For the NH_3 synthesis the catalytic activity rises similarly but reaches the max. at the 1st element of the 8th group. The catalyst activity is explained by the chemisorption bond energy of the metal to H or N, which becomes smaller with the completion of the d level, whereas the reaction velocity could depends on av. bond energy values of the reacting substances with the catalyst surface. The catalytic properties of the metals may change substantially by interaction with the components of the reacting mixt.   W. N. Sternberg

BORESKOV, G. K.

The following papers were presented at the Annual Meeting of the German Chemical Society in Leipzig, 28 October - 1 November 1958:

BALANDIN, A. A. (AS USSR, Moscow)
"Toward the Construction of a Unified Theory of Catalysis - Structure and Energy Factors."

BORESKOV, G. K. (Physico-Chemical Inst. im Karpov, Moscow)
"Reciprocal Influence of Reagent Systems and Catalysts."

BRAUNSHTEYN, A. Ye. (Inst. of Biological and Medical Chemistry, AMS,USSR, Moscow)
"General Questions of Biological Catalysis in the Light of the Activity of the Pyridoxalensyme."

EMANUEL, K. (Inst. Chemical Physics, AS USSR, Moscow)
"Homogeneous Catalysis and Chemical Induction in Slow Oxidation - Chain Reaction."

ROGINSKIY, S. Z.
"Mechanism and Kinetics of the Half-Life Catalyst."

SHILOV, K. and YASNIKOV, A. (Inst. Organic Chemistry, AS Ukrainian SSR)
"Mechanism of Catalytic Action of Aminoacids in the Reaction of Carbonyl Compounds."

VILESOV, P. and TERENIN, A. (Physics Inst., Leningrad State University)
"Photoelectronic Emission on the Surface of Half-Life Catalysts."

SO: Chemische Technik, October 1958, Uncl.

AUTHORS: Kasatkina, L. A., Boreskov, G. K., Krylova, Z. L.,
              Popovskiy, V. V.   153-58-1-3/29

TITLE: Investigation on the Mobility of Oxygen in Vanadium-Pentoxide
              by Means of the Isotope-Exchange Method (Issledovaniye
              podvizhnosti kisloroda pyatiokisi vanadiya metodom izotopnogo
              obmena)

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy. Khimiya i khimiches-
              kaya tekhnologiya, 1958, Nr 1,pp. 12 - 19 (USSR)

ABSTRACT: Vanadium pentoxide forms the active component of many oxi-
              dizing catalysts (vanadium contact-masses with the production
              of H_2SO_4,catalysts of the naphthalene-, anthracene-oxidation
              and of other production). It was interesting to compare the
              catalytical activity of V_2O_5 and the readiness of the ex-
              change of its oxygen against the molecular-oxygen and the
              steam. A survey of the publications (References 1 to 4)
              dealing with this problem is given. It is followed by an ex-
              perimental part with the description of the methods. The
Card 1/3   following conclusions were drawn from the results obtained:

Investigation on the Mobility of Oxygen in Vanadium-Pentoxide by Means
of the Isotope-Exchange Method   153.-58-1-3/29

1)After an investigation of the isotopic exchange of the
vanadium pentoxide with oxygen (at 450,500,530 and 550°C)
and with steam (at 200,385 and 450°C), it was found that
the exchange with oxygen at all above-mentioned temperatures
is accelerated very rapidly. At 200° , an exchange against
steam does not take place.
2)It was proved that the exchange with steam (figures 7 to
9) takes place at lower temperatures and at greater ve-
locities than with molecular oxygen (figures 1 to 6).
3) An addition of potassium-sulfate increases the exchange-
ability of pentoxide both with oxygen and with steam.
4) The exchange between the vanadium-preparations and the
molecular oxygen is determined by the exchange on the sur-
face and takes place according to the first order. In the
case of steam the velocity of surface-exchange is considerab-
ly higher; the oxygen diffusion does not follow the equali-
zation of the isotopic composition in the interior of the
crystal, so that the velocity of exchange decreases more
Card 2/3   rapidly with increasing degree of exchange, than this would

Investigation on the Mobility of Oxygen in Vanadium-Pentoxide by Means
of the Isotope-Exchange Method   153-58-1-3/29

               correspond to the equation of first order.There are 9
               figures and 7 references, 6 of which are Soviet.

ASSOCIATION: Moskovskiy khimiko-tekhnologicheskiy institut imeni D. I.
             Mendeleyeva, Kafedra tekhnologii razdeleniya i primeneniya
             izotopov (Moscow Chemical Technological Institute imeni
             D. I. Menedeleyev, Professorial Chair for the Technology
             of the Separation and Use of Isotopes)

SUBMITTED: October 22, 1957

Card 3/3

BORESKOV, G.K.

Certain aspects of the theory of catalyst selection.
Probl.fiz.khim. no.1:101-110 '58.   (MIRA 15:11)

1. Laboratoriya tekhnicheskogo kataliza Nauchno-issledovatel'skogo
fiziko-khimicheskogo instituta im. Karpova.
                    (Catalysts)
                (Chemical reaction, Rate of)

SOV/64-58-4-2/2o

AUTHORS: Vlasenko, V. M., Candidate of Chemical Sciences,
             Boreskov, G.K., Corresponding Member, Academy of Sciences, USSR,
             Braude, G. Ye.

TITLE: The Catalytic Purification of the Nitrogen-Hydrogen Mixture
             of CO (Kataliticheskaya ochistka azoto-vodorodnoy smesi ot CO)

ABSTRACT: As the presence of oxygen and carbon monoxide in the gas mix-
             ture in the ammonia synthesis acted as a catalyst poison,
             it has often been tried to investigate and remove it; the
             present work mentions results of investigations on the prob-
             lem mentioned above in the case of low temperature with nickel
             catalysts being used. From the data on the conditions of
             equilibrium of the hydration of carbon monoxide may be seen
             that the equilibrium concentration of CO increases highly
             with the concentration of carbon oxide in the initial mixture
             and that it decreases with an increase of pressure. The
             equilibrium content of CO in the gas mixture increases with
Card 1/3   the temperature as well. When the purification process is

SOV/64-58-4-2/2o

The Catalytic Purification of the Nitrogen-Hydrogen Mixture of CO

carried out at 3oo atmospheres a good effect oan also be ob-
tained at higher temperatures, while below 3oo^o all experi-
ments showed that the hydration is irreversible. The investi-
gations of catalysts carried out show that nickel is the
most active of the nonprecious metals; a porous catalyst with
a highly developed inner surface was used. The schematic
representation of a high-pressure plant is enclosed from
which among other things it can be seen that a constancy of
the pressure was obtained by means of a regulator according
to I. P. Sidorov (Ref 13). It was observed that the hydration
takes place with sufficient velocity already at 1oo^o, the
degree of transformation changing with the temperature and
the pressure. Starting from 125° the velocity of the increase
of the degree of transformation is slowed down which is ex-
plained by an external diffusion on the catalyst; this is
represented by an equation where the coefficient of the mass
transfer as well as the pressure were fixed. In case
oxygen and carbon monoxide are present together in the syn-
thesis of ammonia in the gas mixture the completeness of the
gas purification is dependent on the hydration of carbon oxide.
There are 6 figures, 6 tables, and 14 references, 7 of which
are Soviet.

Card 2/3

SOV/64-58-4-2/20

The Catalytic Purification of the Nitrogen-Hydrogen Mixture of CO

ASSOCIATION: Gosudarstvennyy nauchno-issledovatel'skiy i proyektnyy in-
              stitut azotnoy promyshlennosti
              (State Scientific Research and Design   Institute of Nitro-
              gen Industry)

              1. Hydrogen mixtures--Purification   2. Carbon monoxide--Chemical
              reactions   3. Nickel catalysts--Applications

Card 3/3

·5(1)
AUTHORS: Vlasenko, V. M., Candidate of Chemical   SOV/64-58-8-6/19
                Sciences, Boreskov, G. K., Corresponding Member, Academy of
                Sciences, USSR, Braude, G. Ye.

TITLE: The Catalytic Purification of a Nitrogen-Hydrogen Mixture
                From Carbon Dioxide (Kataliticheskaya ochistka azoto-vodorod-
                noy smesi ot dvuokisi ugleroda)

PERIODICAL: Khimicheskaya promyshlennost', 1958, Nr 8,
                pp 473 - 475 (USSR)

ABSTRACT: In the production of ammonia the nitrogen-hydrogen mixture
                is carefully purified from substances containing oxygen prior
                to the synthesis. The purification process can be simplified
                by hydrogenating CO and CO_2 simultaneously, which requires
                highly active catalysts. The results of tests carried out
                with a porous nickel catalyst are given. The properties of the
                catalyst as well as the investigation technique have already
                been described (Ref 1). It is known that the hydrogenation
                of CO in the gas purifying apparatus is practically irreversi-
                ble (Ref 1). A diagram (Fig 2) shows the dependence on
Card 1/3   temperature of the equilibrium concentration of CO_2 at varying

The Catalytic Purification of a Nitrogen-Hydrogen Mixture SOV/64-58-8-6/19
From Carbon Dioxide

pressures and concentrations of the admixtures in the nitrogen-
hydrogen mixture. This shows that at temperatures below
$300°$ the formation of methane is just as irreversible as that
of CO. The process of purifying the nitrogen-hydrogen mixture
from CO_2 was studied at 1, 10, and 300 atmospheres, while the
simultaneous hydrogenation of CO and CO_2 was carried out
at 1 and 300 atmospheres. At atmospheric pressure the hydro-
genation of CO_2 takes place at a temperature of $125°$, and
at 300 atmospheres at $80°$ (Table 1). The hydrogenation of
CO is accomplished more easily (Table 4). The hydrogenation
of CO_2 takes place at 300 atm, a CO_2 concentration of
0.02%, a linear velocity of the gas of up to 0.02 cm per
sec, and a temperature of more than $125°$ in the area of ex-
ternal diffusion. For these conditions an equation (3) is
given by which the mass transfer coefficient can be calculated.
The degree of purification of the nitrogen-hydrogen mixture
is determined by the hydrogenation of the CO_2. There are
3 figures, 6 tables, and 2 references, 1 of which is Soviet.

Card 2/3

The Catalytic Purification of a Nitrogen-Hydrogen Mixture SOV/64-58-8-6/19
From Carbon Dioxide

ASSOCIATION: Gosudarstvennyy nauchno-issledovatel'skiy i proyektnyy institut
               azotnoy promyshlennosti (State Scientific Research and
               Planning Institute for the Nitrogen Industry)

Card 3/3

5(4)

AUTHOR: Boreskov, G. K.   SOV/76-32-12-13/32

TITLE: The Interaction Between Catalyst and Reacting System (Vzai-
              modeystviye katalizatora i reaktsionnoy sistemy)

PERIODICAL: Zhurnal fizicheskoy khimii, 1958, Vol 32, Nr 12,
              pp 2739 - 2747 (USSR)

ABSTRACT: In the course of the reaction the catalyst may undergo
              the following changes: 1) a transformation of the active
              component of the catalyst; 2) a change in the inner com-
              position of the catalyst; and 3) a change in its surface
              layer. The transformation of the catalytic component is
              easily discernible and can be avoided by selecting appro-
              priate catalysts. Changes within the catalyst body are
              less obvious but always to be found. They can extend to
              the entire volume but very often confine themselves to
              the surface. In connection with the formation of monomo-
              lecular layers of oxygen on platinum, silver, and nickel
              references 8, 9 and 10 are mentioned. The influence of the
              composition of solids on catalytic properties is given
Card 1/2   by the fact that atoms of solids are connected with each

The Interaction Between Catalyst and Reacting System   SOV/76-32-12-13/32

other. If an emission or admission of electrons takes place on the surface, this has an effect on the structure of the entire solid. The stationary state of the catalyst depends on the speed of partial reactions which cause a state of equilibrium. If the equilibrium is reached slowly, the previous treatment of the catalyst is decisive for its activity. References 11-14 and 20 are mentioned in connection with the various catalytic properties of zinc oxide, nickel - I - oxide, and vanadium pentoxide treated in different ways. If the equilibrium is reached quickly, the activity is predominantly determined by the composition of the reaction mixture. This means, in practice, that it is possible to regulate the properties of a catalyst by changing the reaction mixture. There are 4 figures and 20 references, 11 of which are Soviet.

ASSOCIATION: Fiziko-khimicheskiy institut im. L. Ya. Karpova, Moskva
                (Physico-Chemical Institute imeni L. Ya. Karpov, Moscow)
SUBMITTED: December 13, 1957
Card 2/2

AUTHORS: Boreskov, G. K., Kuchayev, V. L.   20-119-2-31/60

TITLE: The Catalytic Activity of Germanium in Relation to the
                Isotopic Exchange Reaction Between Hydrogen and Deuterium
                (Kataliticheskaya aktivnost' germaniya v otnoshenii
                reaktsii izotopnogo obmena vodoroda s deyteriyem)

PERIODICAL: Doklady Akademii Nauk SSSR, 1958, Vol 119, Nr 2,
                pp 302-304 (USSR)

ABSTRACT: The present paper compares the specific catalytic activity
                of a germanium semiconductor element with the activity
                of the transition metals having incompletely filled
                d-zones. This comparison is here made with respect to the
                reaction of isotopic exchange of hydrogen with deuterium.
                The authors investigated the catalytic activity of
                germanium by means of the static method with circulation.
                The content of HD in the hydrogen-deuterium mixture was
                determined by means of the method of thermal conductivity.
                The reactiom took place in a reaction vessel of quartz
Card 1/4   within the temperature interval 330° - $550^\circ C$, the equimolar

The·Catalytic Activity of Germanium in Relation   20-119-2-31/60
to the Isotopic Exchange Reaction Between Hydrogen and Deuterium

mixture of hydrogen, with deuterium having had a
pressure of 90 - 190 mm torr. Monocrystalline germanium
with an electronic line of the resistance 6 Ohm.cm
served as catalyst. The gases hydrogen and deuterium
used for reaction were produced electrolytically.
The formula used for the calculation of the specific
catalytic activity of germanium is given; it is valid
for random mechanisms of the exchange of hydrogen and
deuterium. A diagram shows the dependence of the catalytic
activity of the two investigated germanium samples on
the inverse temperature. The activation energy of the
reaction amounted to 17 kcal/g-mol. The specific·
catalytic activity of the two germanium samples amounted
to $330°\sim3.10^{-10}$ g-mol/cm^2.sec. The catalytic activity
of the samples determined! at 650°C was a little greater.
The reaction order was investigated with one of the two
germanium samples at 480°C. The same degree of transformation
at various pressures shows that the reaction takes place

Card 2/4

The Catalytic Activity of Germanium in Relation   20-119-2-31/60
to the Isotopic Exchange Reaction Between Hydrogen and Deuterium

according to the first order. A table contains the
specific catalytic activities of germanium and of some
metals in relation to the reaction of the oxygen-deuterium
exchange at 300°C and at a pressure of the mixture of
40 torr. In the experiments discussed here the exchange
takes place according to the absorption-desorption
mechanism when the surface of germanium is only little
filled and when the absorption is the limiting stage of
reaction. In the transition to a stronger filling of the
germanium surface the activation energy of the reaction
must obviously increase and approach the desorption
energy of hydrogen (about 41 kcal/g-mol). The catalytic
activity of the metals of period IV increases with
growing atomic number and reaches a maximum with nickel.
The catalytic activity decreases strongly in the
transition from nickel to copper. There are 1 figure,
2 tables, and 2 references, 1 of which is Soviet.

Card 3/4

The Catalytic Activity of Germanium in Relation   2U-11S-2-31/60
to the Isotopic Exchange Reaction Between Hydrogen and Deuterium

ASSOCIATION: Nauchno-issledovatel'skiy fiziko-khimicheskiy institut
                im. L. Ya. Karpova (Physico-Chemical Scientific Research
                Institute imeni L. Ya. Karpov)

PRESENTED: October 9, 1957, by A. A. Balandin, Member, Academy of
                Sciences USSR

SUBMITTED: October 1, 1957

Card 4/4

5(2)

AUTHORS: Boreskov, G. K., Corresponding Member,   SCV/2o-123-1-23/56
              Academy of Sciences, USSR,Gorbunov, A. I., Masanov, O. L.

TITLE: Isotopic Exchange in Molecular Nitrogen on Iron Catalysts
              Used in the Synthesis of Ammonia (Izotopnyy obmen
              v molekulyarnom azote na zheleznykh katalizatorakh sinteza
              ammiaka)

ABSTRACT: It was proved (Refs 1-3) that the addition of K_2O
              and Al_2O_3 to the iron catalysts increases their specific

              activity (related to unit surface) with regard
              to the synthesis of ammonia at high pressure. Once or
              twice activated samples have proved to be much more
              active than a non-activated iron catalyst. The acti-
              vating effect of K_2O was more marked than that of Al_2O_3.
              The published views regarding the effect of these
              additions at atmospheric pressure are rather at
Card 1/4   variance (Refs 4,5). Therefore an additional, more

Isotopic Exchange in Molecular Nitrogen on Iron   SOV/20-123-1-23/56
Catalysts Used in the Synthesis of Ammonia

                    comprehensive investigation of the problem under
                    review with various contents of activator became
                    necessary. The method of the experiment was already
                    previously described in detail (Ref 5). Table 1 gives
                    the values of the activation energy, of the order of
                    reaction and of the specific catalytic activity K(P,t)
                    at corresponding pressure and temperature for the
                    samples investigated: It can be concluded from this
                    that the activated catalysts, as far as their specific
                    activity is concerned, considerably surpass the Armko
                    iron (without activator) (in accord with reference 5).
                    There is quite a definite parallelism in the accelerating
                    effect of the mentioned additions exerted on the
                    processes of the ammonia synthesis and of the isotopic
                    nitrogen exchange. This fact is difficult to under-
                    stand if it is taken for proved (Refs 7-9) that the
                    limiting stage in the ammonia synthesis is due to the
                    hydrogenation of the adsorbed nitrogen. If it is
                    assumed that the isotopic exchange and the synthesis
     Card 2/4   of ammonia pass a common stage, nitrogen adsorption,

Isotopic Exchange in Molecular Nitrogen on I_{ron}
Catalysts Used in the Synthesis of Ammonia   SOV/2o-123-1-23/56

the rates of both reactions may be quantitatively
compared with each other. Here, the filling of the
surface of the catalyst by the adsorbed nitrogen
must be cosidered (Ref 5). The calculation shows that
the absolute rates of reaction of the ammonia synthesis
and of the isotopic exchange proved to be similar in
samples once activated and in Armko-iron, at equal
covering by adsorbed nitrogen (the data of N.M.Morozov
from the laboratory of Professor M.J.Temkin were uti-
lized). Thus, the evidence presented in this paper con-
firmed the mechanism of Temkin-Pyzhev (Ref 10) regarding
the isotopic exchange on iron-ammonia catalysts. There
are 1 table and 10 references, 7 of which are Soviet.

ASSOCIATION: Fiziko-khimicheskiy institut im.L.Ya.Karpova (Physice-
                Chemical Institute imeni L.Ya.Karpov) Moskovskiy
                khimiko-tekhnologicheskiy institut im. D.I.Mendeleyeva
                (Moscow Institute of Chemical Technology imeni D.I.
Card 3/4   Mendeleyev)

24(8),25(5)
·AUTHORS: Shendrik, M. N., Boreskov, G. K.   SOV/64-59-3-12/24

TITLE: Calculation of an Adiabatic Reactor for Endothermic Processes
              (Raschet adiabaticheskogo reaktora dlya endotermicheskikh
              protsessov)

PERIODICAL: Khimicheskaya promyshlennost', 1959, Nr 3, pp 55-57 (USSR)

ABSTRACT: Since a number of endothermic processes recently has been
              carried out in industry by means of adiabatic reactors (for
              instance producing divinyl of butylene, styrene of ethyl
              benzene and alcohols of esters), the development of a method
              for calculating those reactors is of special interest.
              A graphic method was developed, based upon the general method
              for the computation of the catalyst volume with which exo-
              thermic, reversible reactions take place. It was found that the
              task lies mainly in the definition of the quantity τ
              (τ - fictitious contact time) in seconds, according to the
              equation (1). Isotherms are given for the dehydration of
              isopropylbenzene which represent the function of the degree of
              transformation α of τ (Fig 1), carried out in the Giprokauchuk.
              The temperature function t of α for the process mentioned above,
Card 1/2   computed according to an equation (4), is also represented

Calculation of an Adiabatic Reactor for   SOV/64-59-3-12/24
Endothermic Processes

graphically (Fig 2). The graphic method of definition is also
represented in the same example (dehydration of isopropyl-

benzene) by means of a diagram $\dfrac{d\tau}{d\alpha} - \alpha$ (Fig 3). It is

pointed out that the change of the catalyst activity has to be
considered, and therefore the value computed for τ has to be
multiplied by the coefficient 1.15 . The dehydration of iso-
propylbenzene was also examined on a large scale (Ref 4).
Conditions and some results are given (Table). There are
3 figures, 1 table, and 4 references, 3 of which are Soviet.

Card 2/2

5(1)   SOV/64-59-5-25/28
AUTHOR: Zlotin, L.

TITLE: Conference of Workers of the Synthetic Ethyl Alcohol Industry
             Branch

PERIODICAL: Khimicheskaya promyshlennost', 1959, Nr 5, p 459 (USSR)

ABSTRACT: The regular branch conference took place this year in Novo-
             kuybyshevsk from July 14th to 17th, to discuss problems of the
             industry of synthetic ethanol. The conference was convened by
             Upravleniye komiteta Soveta Ministrov SSSR po khimii (Admini-
             stration of the Committee for Chemistry of the Council of Mini-
             sters of the USSR) and by the Kuybyshev sovnarkhoz. Delegates
             from all plants of synthetic alcohol, of the Gosplan program
             SSSR and of the Gosplan program RSFSR and of the Goskhimkomitet
             as well as leading workers of the Novokuybyshevsk and of a
             number of research institutes (Fiziko-khimicheskiy institut
             imeni Karpova (Institute of Physical and Chemical Sciences),
             VNIIneftekhim, NIISS and others), of the Kuybyshevskiy industri-
             al'nyy institut (Kuybyshev Institute of Industry), of the
             Planning Institutes (Giprokauchuk, Giprogastopprom), of the pe-
Card 1/3   troleum refineries, etc.participated in this conference, which

Conference of Workers of the Synthetic Ethyl Alcohol   SOV/64-59-5-25/28
Industry Branch

was attended by 300 persons. It was opened by Comrade I. M. Burov, Secretary of the Kuybyshevskiy oblastnyy komitet KPSS (Kuybyshev oblast' Committee of the CPSU). Lectures were held in the plenary sessions concerning the tasks of the industry of synthetic ethanol (L. I. Zlotin (Goskhimkomitet)), and reports were made on the work of the plants during the year 1958 and during the first quarter of 1959 (I. A. Valushko - Kuybyshevskiy zavod sinteticheskogo spirta (Kuybyshev Plant of Synthetic Alcohol)), A. P. Litvin - Groznenskiy khimicheskiy zavod (Groznyy Chemical Plant), I. A. Anisimov - Saratovskiy zavod sinteticheskogo spirta (Saratov Plant of Synthetic Alcohol), A. V. Likhachev - Orskiy zavod sinteticheskogo spirta (Orsk Plant of Synthetic Alcohol), M. M. Ryabova - Ufimskiy zavod sinteticheskogo spirta (Ufa Plant of Synthetic Alcohol), M. Ya. Klimenko - NIISS). Lectures were also held on the follow-ing subjects: On the decrease of the prime cost of alcohol (Ye. P. Shchukin - NIISS), on the optimum conditions of ethylene hydration (Corresponding Member of AS USSR G. K. Boreskov), on foreign investigations concerning the production of synthetic

Card 2/3   alcohol and their analysis in the USSR (Doctor of Technical Sciences,

Conference of Workers of the Synthetic Ethyl Alcohol   SOV/64-59-5-25/28
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M. A. Dalin), on the utilization of by-products of the pro-
duction of synthetic ethanol (Director of TsZL Orskogo zavoda
S. D. Razumovskiy (Central Plant Laboratory of the Orsk Plant
S. D. Razumovskiy)), on further automation of alcohol produc-
tion (V. V. Aranovich - Giprokauchuk), on rust protection (A. B.
Neyman - NIISS), on production of ethylene (T. I. Bogolepova -
Giprokauchuk). During the conference 5 study groups discussed
the following problems: Preparing of raw material, ethylene
production, alcohol production, the economic, automatic and pro-
duction control. 30 lectures were held. It was decided, among
others, to disregard the building of 2-3 new plants and the
workers were appealed to accomplish the new 7-Year Plan in 6
years.

Card 3/3

5(4)
AUTHOR: Boreskov, G. K.   SOV/76-33-9-13/37

TITLE: Effect of the Interaction Between the Reaction System and the
                  Catalyst on the Kinetics of Catalytic Reactions

PERIODICAL: Zhurnal fizicheskoy khimii, 1959, Vol 33, Nr 9, pp 1969-1975
                  (USSR)

ABSTRACT: If, in an interaction between a reaction mixture and the catalyst,
                  the stable composition of the latter is obtained fairly soon,
                  this change in the catalyst (caused by a change in composition
                  of the reaction mixture) will exert a noticeable influence on
                  the kinetics of the catalyzed reaction. The influence of the
                  concentration of the reaction mixture components on the reaction
                  rate will be thus exerted in two directions: by the collision
                  number of reacting particles, considering the surface con-
                  centration of chemisorbed particles on the catalyst, and by
                  the effect of the reaction mixture on the properties of the
                  catalyst, i.e. on the "constant" of the reaction rate. Many
                  phenomena that were explained by the heterogeneity of the
                  catalyst surface, are actually due to the said effect of the
                  reaction mixture on the catalyst properties. On the strength
Card 1/2   of examples with the reaction kinetics of an oxidation occur-

SOV/76-33-9-13/37

Effect of the Interaction Between the Reaction System and the Catalyst on the Kinetics of Catalytic Reactions

ring on an arbitrary oxidation catalyst by the passage of oxygen atoms between the reacting components, it is shown that the form of the kinetic curves of some oxidation reactions can be explained by the effect of the reaction mixture on the catalyst properties, whereas it had been formerly explained by the assumption of a heterogeneous chemisorption energy on the catalyst surface. The following names are quoted in the paper: N. V. Kul'kova, M. I. Temkin, T. I. Sokolova, S. Z. Roginskiy. There are 9 references, 8 of which are Soviet.

SUBMITTED: February 22, 1958

Card 2/2

5(4)

SOV/20-127-1-39/65

AUTHORS: Khar'kovskaya, Ye. N., Boreskov, G. K., Corresponding Member
AS USSR, Slin'ko, M. G.

TITLE: The Kinetics of Interaction Between Hydrogen and Oxygen on
Platinum (Kinetika reaktsii vzaimodeystviya vodoroda s
kislorodom na platine)

PERIODICAL: Doklady Akademii nauk SSSR, 1959, Vol 127, Nr 1, pp 145-148
(USSR)

ABSTRACT: The measuring results hitherto supplied by publications
concerning the interaction mentioned in the title are contra-
dictory (Refs 1-5). Experiments were made within too narrow
concentration ranges or under conditions that did not allow
accurate measurements. The mentioned interaction was therefore
carried out at temperatures of from 20 to 180°, pressure of
from 50 to 750 torr and different compositions of the reaction
mixtures in a circulation system. Investigations were made on
hydrogen, nitrogen-hydrogen mixtures, nitrogen-oxygen mixtures
and oxygen. Platinum was used in the form of 0.1 mm gauge wire.
The circulation rate varied between 400 and 1100 l/h. The
reaction rate proved to be independent of the circulation rate
and of the nitrogen partial pressure; it depended only on the

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The Kinetics of Interaction Between Hydrogen   SOV/20-127-1-39/65
and Oxygen on Platinum

partial pressure of hydrogen and oxygen. Figs 1-3 show the
measuring results for the different concentrations and
temperatures as well as the influence of the pre-treatment of
platinum with hydrogen at increased temperatures, figure 4 the
dependence of the reaction rate on the H_2- and O_2 concentration
at 180°. Experimental data are indicative of a complicated
catalytic process. In mixtures with hydrogen excess, the
reaction of the first order (referred to O_2) and its being
little dependant on the pressure of H_2 , permit the conclusion
to be drawn that here the interaction between chemically sorbed
atomic hydrogen, which covers the platinum surface, and
molecular oxygen, forms the limiting stage. The oxygen reaction
is made easier by interaction with the d-electrons of the
catalyst (adsorption type C according to Dowden, Ref 11).
If the oxygen is not altogether removed from the platinum
surface, O-atoms remain adsorbed to the surface by means of the
d-electrons of the metal (type B), and the activity of platinum
Card 2/4   drops. When passing over to stoichiometric H_2-O_2-mixtures,

The Kinetics of Interaction Between Hydrogen   SOV/20-127-1-39/65
and Oxygen on Platinum

the platinum surface is freed from hydrogen, and a chemical
sorption of the oxygen with dissociation into atoms is made
possible. (Type A). In this range the reaction proceeds by
interaction of the atomically adsorbed oxygen with H_2; this

requires less activating energy, and causes an increased
reaction rate. In the case of oxygen excess, two stationary
conditions are possible, which differ by the reaction rate and
dependence on concentration of the components. The readily
occurring reaction is likely to be related with a chain
process, in which high-energy endothermal products participate,
which are regenerated in the course of reaction. On lowering
the temperature and temporarily evacuating the system, these
unstable products vanish, and there only remains a relatively
tightly platinum-adsorbed oxygen which reacts with hydrogen
slowly and with increased energy demand. The decreased

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The Kinetics of Interaction Between Hydrogen   SOV/20-127-1-39/65
and Oxygen on Platinum

reaction rate at increased oxygen pressure is probably due to
a partial blocking of the platinum surface by tightly adsorbed
oxygen. There are 4 figures and 11 references, 8 of which are
Soviet.

ASSOCIATION: Nauchno-issledovatel'skiy fiziko-khimicheskiy institut im.
L. Ya. Karpova (Scientific Research Institute of Physical
Chemistry imeni L. Ya. Karpov)

SUBMITTED: March 30, 1959

Card 4/4

5 (4)

AUTHOR: Boreskov, G. K., Corresponding Member,   SOV/20-127-3-32/71
               AS USSR

TITLE: The Influence of the Displacement of the Level of the Chemical
               Potential of Electrons Upon the Activity of Semiconductor
               Catalysts

ABSTRACT: The level of the chemical potential of a catalytic reaction is,
               by its immediate connection with the formation energy of the
               surface intermediate bond, in connection with the catalytic
               activity of semiconductors. For the purpose of investigating this
               connection the simple example of the chemisorption of a particle A
               with formation of a charged particle A^+ on the catalyst
               surface is dealt with. The adsorption heat Q of the process is
               then $Q = \varphi - I_A + W_{A+K}$; φ is the work function for the electron,
               which immediately determines the level of the chemical potential.
               It depends on the electron structure of the semiconductor and on
               the concentration of the adsorbed substance (the surface charge
               formed influences φ). I_A - the ionization energy is determined

Card 1/4   only by the properties of the adsorbed molecule. W_{A+K} is the

The   Influence of the Displacement of the Level of the   SOV/20-127-3-32/71
Chemical Potential of Electrons Upon the Activity of Semiconductor Catalysts

interaction energy of the ion A^+ with the catalyst, it is
dependent on the position of the adsorbed particle on the catalyst
surface. The influence of a slight variation of φ or the influence
produced by additions upon the sorption rate is investigated. By
way of simplification it is assumed that in this connection a
variation of W_{A+K} may be neglected, as also the variation of φ
is neglected with occupation of the surface. It then holds that
$Q = Q_0 + \Delta\varphi$, and the degree of surface occupation

$$\theta = \frac{bp_A}{1+bp_A}$$ (2) with b-adsorption coefficient and p_A-pressure of

the substance A. For sorption equilibrium, when adsorption and
desorption rate, ω_1 ω_2, are equal, the expression

$$\omega_1 = \omega_2 = K_{o2} \frac{p_A b_o e^{Q_o/RT} e^{\alpha\Delta\varphi/RT}}{1 + p_A b_o e^{Q_o/RT} e^{\Delta\varphi/RT}}$$ is found (3). It increases

with the increase of φ at small θ, and decreases again at large θ.
The maximum corresponds to the value φ, for which $\theta = \alpha$, which

Card 2/4   is in agreement with the general results obtained by M. I. Temkin.

The Influence of the Displacement of the Level of the SOV/20-127-3-32/71
Chemical Potential of Electrons Upon the Activity of Semiconductor Catalysts

When the variation of φ with the occurrence of surface charge
is taken into account, this maximum is not displaced, but the
state $\theta = \alpha$ is attained at a chemical potential at which it is
reduced by $\delta_{\varphi_{\theta=\alpha}}$ compared to φ if the influence of the resultant
surface charge is neglected. In the case of an inhomogeneous
surface, the rules continue to hold only within the homogeneity
ranges. The conclusions are applied to oxide catalysts.
Figure 2 shows the variation of the activation energy of the
reaction of the isotopic exchange in molecular hydrogen in the
case of reduction of the chemical potential, and figure 3 shows
the special influence in the case of interaction on the surface
with transition of an electron from the reacting substance to the
catalyst. If the chemical potential is reduced, the activation
energy of adsorption decreases, and that of desorption rises. The
process, which may also develop with the transfer of an electron
to the adsorbed substance, leads, with an increase of the chemical
potential, to a decrease of the activation energy, and the latter
again increases with transformation of the intermediate product.

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The Influence of the Displacement of the Level of the   SOV/20-127-3-32/71
Chemical Potential of Electrons Upon the Activity of Semiconductor Catalysts

> The connection between catalytic activity and the free energy of
> oxide dissociation is briefly discussed. There are 3 figures
> and 5 Soviet references.

ASSOCIATION: Nauchno-issledovatel'skiy fiziko-khimicheskiy institut im. L. Ya.
      Karpova (Scientific Research Physico-chemical Institute imeni
      L. Ya. Karpov)

SUBMITTED: May 13, 1959

Card 4/4

BORESKOV, G. K.

5(4)
AUTHORS:

SOV/20-127-5-28/58

Boreskov, G. K., Corresponding Member AS USSR, Vasilevich, A. O.

TITLE: The Mechanism of Isotopic Exchange in Molecular Hydrogen in Platinum Films

ABSTRACT: This investigation was carried out for the purpose of finding out whether the exchange mentioned in the title takes place according to the mechanism of an adsorption-desorption or by chain reaction (Refs 1-3). By using tritium adsorbed on platinum foils, the exchange rate at various points of the film and the variable activation energies caused by inhomogeneity of the platinum surface could be measured. The apparatus is shown by figure 1. The platinum film was produced by the atomization of a platinum wire in a vacuum. Figure 2 shows the exchange rate tritium-hydrogen at $90^{\circ}K$, figure 3 – the exchange rate H_2-D_2 at $78^{\circ}K$ and $90^{\circ}K$. Figure 4 shows the dependence of the exchange rate and of the activation energy on the degree of the exchange.

Card 1/2   The conclusion is drawn that exchange takes place according to

The Mechanism of Isotopic Exchange in Molecular Hydrogen in Platinum Films   SOV/20-127-5-28/58

an adsorption-desorption mechanism. The great difference in activation energies (about 7.5 kcal/mol at temperatures of more than $273^\circ K$, 1-0.5 kcal/mol at lower temperatures) could be explained by the fact that at low temperatures only small parts of the surface are active, whereas on the major part of the surface the reaction is smaller by $1 \cdot 10^{-9}$. The active sections may be caused by impurities, adsorption of other gases, inhomogeneous distribution of the adsorbed atoms, etc. At higher temperatures the difference in the activation energies of the individual sections are smaller, so that the film reacts practically homogeneously. Although the adsorption-desorption mechanism may be looked upon as probable, the production of complicated active complexes is not to be excluded. There are 4 figures and 7 references, 3 of which are Soviet.

ASSOCIATION: Nauchno-issledovatel'skiy fiziko-khimicheskiy institut im. L. Ya. Karpova (Scientific Physico-chemical Research Institute imeni L. Ya. Karpov)

SUBMITTED: May 23, 1959

Card 2/2

BORESKOV, G. K.

BALANDIN, Aleksey A. - "On the theory of contact catalysis of hydrogenation and dehydrogenation reaction" (Section I)

KUSSHY, Georgiy K., and VASILYEVA, A. O. - "On the mechanism of isotope exchange of hydrogen on platinum" (Section I)

RUBR, F. (probably Tabor T. RUNR) - "On the role of intermediate surface forms in some heterogeneous-catalytic reactions of carbon monoxide and olefines" (Section I)

PARUKAI, Lev K, and GORENKOV, V. I. - "Catalytic transformation of cyclohexane and copper and the multiplet theory" (Section II)

MARCHILIBY, Yusuf G., and GORENKOV, M. M. - "Chlorocarbons manufacture by chlorination of alkanes in the fluid bed of a catalyst" (Section II)

NIKOLAEV, L. A. - "Specific aspects of the mechanism of catalysis by complex compounds" (Section II)

FRUMKINA, Yu. I., KLABUNOV, V., and VORVUSSKIY, V.V. - "Investigation of hetero-geneous catalysis by electron spin resonance" (Section II)

RUDOY, A. D. - "On the catalytic synthesis of organosilica compounds" (Section III)

RODISKIY, Simon L. - "Electronic effects in catalysis" (Section I or II)

RUBINSHTEYN, A. M. - "The structure and texture of Chromia-alumina-potassium oxide catalysts" (Section II)

SMIRNOV, M. I., and MELNIKOV, I. F. - "Catalytic transformations in the furanic compound group" (Section III)

MURDISKIY, D. V., and EDMININA, V. P. - "Kinetic and mechanism of catalytic reduction in aromatic nitro derivatives" (Section I)

ROGINSKI, A. V., and BOTEV, AV. - "Active sites on transition metal catalysts, revealed in the infrared spectrum of adsorbed NO." (Section II)

RUGIBINA, E. V., AVULINA, Z. V., and LE BE SHIIR (Possibly LI Ho-seng, Moscow Textile Institute) - "The effects of structural characteristics of porous catalysts on activity and kinetic behavior of heterogeneous-catalytic reactions" (Section I)

VOLKENSHTEYN, T. - "General ideas on the electronic theory in catalysis on semiconductors" (Section I)

ZHUKOVA, B. V., and HILEVOROVA, M. W. - "Catalytic transformation of cyclohexane and copper and the multiplet theory" (Section II)

S/064/60/000/03/03/022
B010/B008

AUTHORS: Boreskov, G. K., Slin'ko, M. G.

TITLE: Computation of Catalytic Processes in Industrial Reaction
                Apparatus

PERIODICAL: Khimicheskaya promyshlennost', 1960, No. 3, pp. 193-201

TEXT: Problems and examples regarding the application of electronic com-
puters for the computation of catalytic contact processes are given and
discussed here. A classification of contact apparatus is given intro-
ductorily (Fig. 1). Computations of the optimum temperature distribution
and the degree of conversion in the individual stages are illustrated by
the contact sulfuric acid production, and computation results obtained
with the M-20 (M-20) electronic computer at the Institut matematiki
Sibirskogo otdeleniya AN SSSR (Institute of Mathematics of the Siberian
Department of the AS USSR) are listed (Table). Exothermic processes in
apparatus with internal heat exchange are explained next, and computations
of the oxidation of ethylene to ethylene oxide, carried out by P. N. Kopay-
Gora, G. M. Ostrovskiy, and Ya. I. Grinya at the Institut schetnogo mashino-

Card 1/2

Computation of Catalytic Processes in   S/064/60/000/03/03/022
Industrial Reaction Apparatus   B010/B008

stroyeniya (<u>Institute of Computer Construction</u>), as well as corresponding
diagrams applying the data by M. I. Temkin et al. (Ref. 3) are shown
(Figs. 7,8). Computations for the application of apparatus with pseudo-
liquid layer in exothermic processes are also mentioned. Computations of
the limit of stable working conditions of contact apparatus are explained
for heterogeneous catalyses by means of pseudoliquid catalyst layers, the
method by A. M. Lyapunov (Ref. 5) applied in mechanics as well as a paper
by D. A. Frank-Kamenetskiy (Ref. 8) are mentioned, and an explanation of the
critical conditions is given. It is finally pointed out that electronic
computers permit the solution of complicated computations of the course
of catalytic processes, such as multi-stage processes with reactions
developing parallel and successively, catalyses in which the activity of
the catalyst drops quickly, etc. There are 10 figures, 1 table, and
8 references: 7 Soviet and 1 American.

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S/064/60/000/006/005/011
B020/B054

AUTHORS: Boreskov, G. K. and Chesalova, V. S.

TITLE: Production of Industrial Catalysts

PERIODICAL: Khimicheskaya promyshlennost', 1960, No. 6, pp. 38-44

TEXT: Catalysts which were initially prepared under laboratory conditions
with primitive equipment in small workshops are now produced on a large
industrial scale. The essential factor is the quality of the catalyst,
the consumption of material being of no, or only inferior, importance.
This factor primarily depends on the chemical composition of the catalyst.
Fig. 1 shows the use of the individual elements of the periodic system as
catalysts in the industry, all natural elements being used except for the
rare gases. The "blank spots" in the table are mainly due to an insufficient
investigation of the respective elements as catalysts; rhenium has
recently gained importance as a catalyst. In the industrial practice,
complicated mixtures are mostly used, the strict observance of the formulas
being of great importance in many cases. As an example. Fig. 2 shows the
change in catalytic activity of aluminum oxide on introduction of NaOH.
Card 1/3

Production of Industrial Catalysts   S/064/60/000/006/005/011
                                                      B020/B054

Fig. 3 gives data on the catalytic activity of Si-Zr catalysts of the same
gross composition, one of them being a mechanical mixture, the other a
chemical compound. The catalytic activity depends, however, also on the
extent of the inner surface. Fig. 4 schematically shows the optimum
porosity of catalysts for various reactions; it is stated that the
properties of the catalyst can be altered by a change in the porous
structure at constant specific activity only. Fig. 5 shows the dependence
of the pore volume of active aluminum oxide on the pH of the solution
during the precipitation of aluminum hydroxide, and on the amount of
nitric acid added during the peptization. Table 2 gives the characteris-
tics of typical carrier materials for catalysts. Fig. 6 shows a cross
section of granules of a palladium catalyst, Fig. 7 the granules of
porous corundum in the form of microspheres (Laboratoriya tekhnicheskogo
kataliza (Laboratory of Technical Catalysis) of the Fiziko-khimicheskiy
institut im. L. Ya. Karpova (Physicochemical Institute imeni L. Ya.
Karpov)), Fig. 8 the variation of the required catalyst amount and of
the hydraulic drag of the catalyst layer with increasing dimensions of
the catalyst granules of unchanged form, and Fig. 9 some special forms of
catalysts and carriers used to form a uniform catalyst layer.

Card 2/3

Production of Industrial Catalysts   S/064/60/000/006/005/011
                                          B020/B054

I. Ye. Neymark (Ref. 5) is mentioned. There are 9 figures, 2 tables, and
9 references: 6 Soviet, 2 US, and 1 British.

Card 3/3

BORESKOV, G.K.; CHESALOVA, V.S.

Manufacture of industrial catalysts. Khim. prom. no. 6:476-482
S '60.
(Catalysts)
(MIRA 13:11)

POPOVSKIY, V.V.; BORESKOV, G.K.

Catalytic activity of oxides of fourth-period metals with respect
to the oxidation of hydrogen. Probl. kin. i kat. 10:67-72 '60.
(MIRA 14:5)

1. Moskovskiy khimiko-tekhnologicheskiy institut imeni D.I.
Mendeleyeva.
(Metallic oxides)   (Catalysts)

KUCHAYEV, V.L.; BORESKOV, G.K.

Relationship between the catalytic activity and semiconductor
properties of germanium. Probl. kin. i kat. 10:108-110 '60.

(MIRA 14:5)

1. Fiziko-khimicheskiy institut imeni L.Ya. Karpova.
(Germanium)

BORESKOV, G.K.

Catalysis on metals. Probl. kin. i kat. 10:128-140 '60.

(MIRA 14:5)

1. Fiziko-khimicheskiy institut imeni L.Ya. Karpova.
(Catalysts)

GORBUNOV, A.I.; BORESKOV, G.K.

Catalysis of isotopic exchange in molecular nitrogen induced by
transition metals of the fourth period. Probl. kin. i kat. 10:192-
198 '60.   (MIRA 14:5)

1. Moskovskiy khimiko-tekhnologicheskiy institut imeni D.I.
Mendeleyeva.
                   (Nitrogen—Isotopes)   (Catalysts)
                          (Transition metals)

BORESKOV, G.K., VASILEVICH, A.A.

Mechanism of the isotopic exchange of hydrogen on platinum
films. Kin. i kat. 1 no.1:69-82 My-Je '60.   (MIRA 13:8)

1. Fiziko-khimicheskiy institut im. L.Ya. Karpova.
          (Hydrogen)   (Deuterium)   (Platinum)

BORESKOV, G.K.; KASATKINA, L.A.; POPOVSKIY, V.V.; BALOVNEV, Yu.A.

Oxygen mobility and the catalytic activity of vanadium pentoxide
promoted with potassium sulfate. Kin.i kat. 1 no.2:229-236
Jl-Ag '60.   (MIRA 13:8)

1. Fiziko-khimicheskiy institut im. L.Ya.Karpova.
               (Vanadium oxide)
               (Potassium sulfate)
               (Oxygen--Isotopes)

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B013/B058

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TITLE: Isotopic Exchange of Hydrogen on Germanium Samples of
                the n- and p-Type

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TEXT: In this paper the authors studied the effect of semiconductor pro-
perties of crystalline germanium on its catalytic activity with respect
to the isotopic exchange of hydrogen with deuterium and the chemosorption
of hydrogen, on germanium samples. Hydrogen and deuterium were produced
by electrolysis. Germanium monocrystals crushed in vacuum, from which 5
samples with various resistivity and various type of conductivity were
prepared, served as catalysts. The catalyst surfaces were measured directly
in the reaction vessel after the adsorption of spectrally pure krypton at
the temperature of liquid nitrogen. The calculation was made according to
the BET method. The relative measuring accuracy amounted to about 5%.

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Table 2 shows the change of the germanium-sample surfaces under the
influence of various temperatures. The catalytic activity of germanium
with respect to isotopic exchange in homomolecular hydrogen was studied
by the static method at pressures of the equimolecular hydrogen-deuterium
mixture of 0.7 and 0.1 mm Hg at from 180 to 280°C. The calculation method
was described in the paper by M. A. Avdeyenko, G. K. Boreskov, and M. G.
Slin'ko (Ref. 9). No noticeable difference in the catalytic activity was
ascertained between samples of different type of conductivity. The rate
of adsorption of hydrogen was studied at room temperature (Table 3) and
at 100°C before testing the catalytic activity. It was determined that
rates of adsorption, energy of activation, and the adsorption as a func-
tion of the surface occupation are almost similar for all 4 samples. The
adsorption isotherms of hydrogen were recorded at 210°, 244°. and 274°C
and don't show any noticeable differences. With an occupation of up to
$\Theta = 0.15$, they correspond to Langmuir's equation for adsorption with
dissociation. The heat of adsorption is 25 kcal/mole. A deviation from
Langmuir's equation and a lower heat of adsorption are to be observed at

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a higher degree of occupation. The solubility of hydrogen in germanium is small and of no effect on the measuring results. As can be seen from the dependence of the rate of desorption on the surface occupation at 180°C (Fig. 10), it drops to one third after removal of about 20% of the adsorbed hydrogen from the germanium surface. It was established that the rate of desorption of the hydrogen-deuterium mixture is about 1.5 times greater than the rate of isotopic exchange, and about 1.5 times smaller than the rate of desorption of hydrogen, under equal conditions. The studies gave the following conclusive results: The rates of hydrogen adsorption and isotopic exchange were almost equal for all samples studied inspite of a change of the concentration of free electrons and holes by 7 to 9 orders of magnitude. This permits the conclusion that the adsorption of hydrogen on germanium proceeds without participation of free electrons or holes, i. e. without surface charge. Similar rates of desorption and isotopic exchange point towards an adsorption-desorption mechanism of the reaction. V. M. Frolov, O. V. Krylov, and S. Z. Roginskiy are mentioned. There are 10 figures, 3 tables, and 18 references: 5 Soviet, 10 US, 1 Dutch, and 3 German.

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Таблица 2

Поверхность образцов германия, $см^2$.

Номер образца	Предварительная температурная обработка при			
	100°	300°	500°	630°
1	2,3	1,9	1,4	1,3*
2	2,0	1,6*	—	—
3	1,8	1,5*	1,1*	—
4	2,1*	1,8*·	—	—
5	—	—	0,05	—

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BORESKOV, G.K.; SLIN'KO, M.G.

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