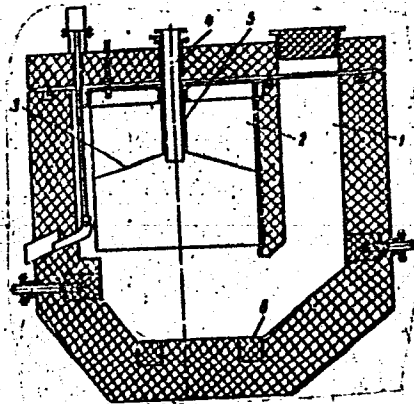L 7998-66
ACC NR: AP5026531

Fig. 1. 1- melting chamber;
2- mixer forehearth;
3- suspended metallic cap;
4- pipe for drawing off
magnesium; 5- liquid
seal; 6- auxiliary
electrodes

during discharging of the charge and removing the molten products. The bottom of the bath is provided with auxiliary electrodes for preventing the formation of crust.
Orig. art. has: 1 figure.

SUB CODE: IE/   SUBM DATE: 16Mar64

nw

Card 2/2

RODYAKIN, V.V.; GARMATA, V.A.; SOKOLON, I.I.; SANDLER, R.A.; ARUTYUNOV, E.A.;
    VLASOV, V.A.; USTINOV, V.S.; ANDREYEV, A.Ye.

Quality of titanium sponge obtained with the use of various
forms of magnesium. TSvet. met. 38 no.8:64-68 Ag '65.
                                        (MIRA 18:9)

RAKOCH, G.M.; SALIN, A.A.; ZINOV'YEV, A.F.; PILIPCHUK, N.A.; KOCHERGIN, A.I.;
TULENKOV, I.P.; SHARAPOV, S.F.; VOLKOVA, V.S.; ROGALIS, Yu.P.;
VLASOV, V.A.

Directions for the technical improvement of the electrolysis
of zinc. TSvet. met. 38 nc.5:22-25 My '65.

(MIRA 18:6)

VLASOV, V.A.; ZYSIN, Yu.A.; KIRIN, I.S.; LBOV, A.A.; OSEYAYEVA,
L.I.; SEL'CHENKOV, L.I.

[Yield of certain fragments in Th^{232} fission by 14.3 Mev.
neutrons] Vykhody nekotorykh oskolkov pri delenii Th^{232}
neitronami s energiei 14,3 mev. Moskva, Glav. upr. po is-
pol'zovaniiu atomnoi energii pri Sovete Ministrov SSSR,
1960. 11 p.
(MIRA 17:4)

SEMILETOV, S.A.; VLASOV, V.A.

Electron diffraction study of phases in the system gallium - tellurium. Kristallografiia 8 no.6:877-883 N-D'63.
(MIRA 17:2)

1. Institut kristallografii AN SSSR i Institut fiziki i matematiki AN Moldavskoy SSR.

VLASOV, Viktor Alekseyevich; YUKHNOVSKAYA, S.I., red.; PETROVA,
            N.K., tekhn. red.

[Gastrointestinal diseases in young children] Zheludochno-
kishechnye zabolevaniia u detei rannego vozrasta. Moskva,
Medgiz, 1963. 18 p.   (MIRA 17:4)

VLASOV, V.A.; VOYEVODIN, Ye.N.; LBOV, A.A.; MARTYNOV, N.P.; NIKITIN, Ye.A.;
UTENKOV, G.G.

Possibility of maintaining low moisture in glove boxes.   Zav.lab.
29 no.5:586-588 '63.   (MIRA 16:5)
                              (Rubber--Permeability)

VLASOV, V.A., prof.

       History of the origin of pediatric journals in the U.S.S.R.
       Pediatriia 41 no.4:3-8 My '62.   (MIRA 15:5)
               (PEDIATRICS—PERIODICALS)

MOROZOV, N.N., inzh.; POLOPRIGORA, A.I.; inzh.; NOVIKOV, A.V.,
inzh.; VLASOV, V.D., inzh.; TARABENKO, N.A., red.

[Manual on safety engineering, industrial hygiene, labor
protection, and fire prevention on state and collective
farms] Spravochnik inzhenera po tekhnike bezopasnosti,
proizvodstvennoi sanitarii, okhrane truda i pozharnoi okh-
rane sovkhoza i kolkhoza. Moskva, Rossel'khozizdat, 1965.
288 p.   (MIRA 18:10)

VLASOV,V.D., in.hener

Group switchgear with automatic adjusters. Svetotekhnika
1 no.4:22-23 Ag '55. (MLRA 8:9)

1. Tyazhpromelektroproyekt
(Electric switchgear)

VLASOV, V.D., inzhener.

Reingorced concrete poles for electric networks and street
lighting. Svetotekhnika 2 no.1:25-26 Ja '56.   (MLRA 9:3)

1. Tyazhpromelektroproyekt.
        (Electric lines--Poles) (Street lighting)

GORSKIY, Lev Ivanovich; VLASOV, V.D., retsenzent; KNORRING, G.M., red.;
SOBOLEVA, Ye.M., tekhn.red.

[Electric apparatus and appliances in industrial enterprises]
Elektrokonstruktsii promyshlennykh predpriiatii. Moskva, Gos.
energ.izd-vo, 1959. 255 p.   (MIRA 12:12)
                (Electric apparatus and appliances)

VLASOV, V. F.

How to calculate optimum dimensions for the lots of metal-cutting tools. Mashinostroitel' no.10:24 C '62.

(MIRA 15:10)

(Metal-cutting tools)

VLASOV, V.F.; TIMAN, A.F.

Relation for integrals of moduli of trigonometric polynomials. Dokl.
AN SSSR 138 no.6:1263-1265 Je '61.   (MIRA 14:6)

1. Predstavleno akademikom S.N.Bernshteynom.
              (Polynomials)   (Integrals)

VLASOV, Viktor Fodorovich; Prinimal uchastiye OVCHINNIKOV, N.I.,
dots.; IZYUMOV, N.M., prof., retsenzent; ITSKHOKI, Ya.S.,
prof., nauchnyy red.; LARIONOV, G.Ye., tekhn. red.

[Course in radio engineering] Kurs radiotekhniki. Moskva, Gos.
energ. izd-vo, 1962. 927 p.   (MIRA 15:3)
                              (Radio)

S/021/62/000/004/004/012
D299/D302

AUTHOR: Vlasov, V.F.

TITLE: On approximation processes of periodic functions by
            trigonometric polynomials

PERIODICAL: Akademiya nauk UkrRSR. Dopovidi, no. 4, 1962, 438-442

TEXT: An asymptotic formula is derived for Lebesgue's function,
which is approximated by trigonometric polynomials. Let

$$K_n(x) = \frac{\lambda_0^{(n)}}{2} + \sum_{k=1}^{n} \lambda_k^{(n)} \cos kx \qquad (1)$$

be a sequence of even trigonometric polynomials with real coeffi-
cients, and $\rho_n(x)$ – a sequence of functions of bounded variation on
$[-\pi, \pi]$, for which Var $\rho_n(x) = 1$. Each continuous 2π –periodic
function is made to correspond with a sequence of trigonometric po-
lynomials

Card 1/3

On approximation processes of ...   S/021/62/000/004/004/012
D299/D302

$$T_{n,r}(f; x; \lambda; \varrho) = \frac{1}{r} \sum_{v=1}^{r} f(t_v) \int_0^{2\pi} K_n(x + u - t_v) \, d\varrho_n(u), \qquad (2)$$

$$(n = 1, 2, 3, \ldots)$$

where $t_v = \frac{2v\pi}{r} (v = 1, 2, \ldots, r), \qquad r \geqslant 2n + 1.$

Various well-known approximation-methods which involve expansion in Fourier series or interpolation of the function f(x) at equidistant points, are particular cases of (2), with different sequences (1) and $\rho_n(x)$. The convergence of the polynomial sequence (2) is related to the behavior of the corresponding sequences of Lebesgue functions, viz.:

$$L_{n,r}(x; \lambda; \rho) = \sup_{/f(t)/<1} /T_{n,r}(f; x; \lambda; \rho)/.$$

The following theorem holds: If the uniformly bounded system of numbers $\lambda_k(n)$ is convex (or concave), and for each positive sequence $\varepsilon_n = O(1/n)$, Var $\rho_n(t) = 1 - O(1/n)$, then the asymptotic formula

Card 2/3

On approximation process of ...

$$\widetilde{L_{n,r}}(x;\lambda;\varrho) = s_{n,r}(\varrho)|c_n|\sum_{k=1}^{n}\frac{\lambda_k^{(n)}}{n-k+1}+O(1), \tag{4}$$

holds, where
$$s_{n,r}(\varrho) = \frac{2n+1}{r}\frac{\cos\frac{2n+1}{r}\pi\left\{\frac{1}{2}+\left[\frac{rx}{2\pi}+\frac{r\varphi_n}{(2n+1)\pi}\right]-\frac{rx}{2\pi}-\frac{r\varphi_n}{(2n+1)\pi}\right\}}{\sin\frac{2n+1}{2r}\pi} \tag{5}$$

provided that $r/(2n + 1)$ is an integer; $(\varphi_n = \arg c_n,\ c_n = \frac{1}{\pi}\int_0^{2\pi}$
$e^{int}d\rho_n(t))$. The theorem is proved on the basis of a lemma, and by
use of Abel's transform. There is 1 Soviet-bloc reference.

ASSOCIATION: Dnipropetrovs'kyy derzhavnyy universytet (Dniprope-
trovs'k State University)

PRESENTED: by Academician Yu.A. Mytropol's'kyy, AS UkrRSR

SUBMITTED: ·September 1, 1961

Card 3/3

VLASOV, V.F.

Constructive characteristic of a certain class of functions.
Dokl. AN SSSR 142 no.4:773-775 F '62.   (MIRA 15:2)

1. Dnepropetrovskiy gosudarstvennyy universitet im. 300-
letiya vossoyedineniya Ukrainy s Rossiyey. Predstavleno akademikom
S.N.Vernzhteynom.
                   (Functions, Continuous)

VLASOV, V.F., dotsent

Calculating the economic efficiency of the reconditioning of worn-out cutting tools. Vest.mashinostr. 43 no.2:82-83 F '63.

(Metal-cutting tools)   (MIRA 16:3)

VELIKANOV, K.M.; VLASOV, V.F.

    Method for calculating the economic efficiency of substituting the
machine tooling of parts with a hot stamping. Trudy LIP no.227:
87-96 '63.
                                                (MIRA 17:4)

VLASOV, V.F.

Determining the economic efficiency of metal-cutting tool
reconditioning. Trudy LIP no.227:125-127 '63.

Methodology for calculating the optimal lot size for metal-cutting
tools manufactured in machinery plants.   Ibid.:128-132
(MIRA 17:4)

ZVYAGINTSEV, A.F.; IVANOV, Yu.N.; KAZAKOV, V.E.; STETSENKO, A.M.;
SOLOMOVICH, M.Ya.; KORZH, V.I.; DASHKEVICH, A.A.; Prinimali
uchastiye: LIPTSEN, S.Kh.; RYZHIKOV, A.P.; STAL'NOKRITSKIY,
V.N.; LEVENETS, L.Ye.; MOGILA, V.A.; KOVAL', A.A.; VLASOV, V.F.;
ROSHCHIN, A.G.; RAYKO, V.P.; KORNIYENKO, V.G.; PANTYUSHKIN, N.V.

Investigating the possibility of manufacturing all-rolled
electric locomotive wheels with existing equipment. Kuz.-shtam.
proizv. 5 no.11:11-14 N '63.

(MIRA 17:1)

L 35883-66   EWT(1)

ACC NR: AP6010775   SOURCE CODE: UR/0146/66/009/001/0090/0096

AUTHOR: Vlasov, V. F.

ORG: Leningrad Military Engineering Academy im. A. F. Mozhayskiy (Leningradskaya voyennaya inzhenernaya krasnoznamennaya akademiya)

TITLE: Discrete smoothing devices

SOURCE: IVUZ. Priborostroyeniye, v. 9, no. 1, 1966, 90-96

TOPIC TAGS: signal noise separation, signal interference

ABSTRACT: The smoothing of a stationary random noise n(t) by a discrete smoother (DS) is theoretically analyzed: the rms error in reproduction of a random stationary desirable signal m(t) and the required dynamic accuracy of reproduction of a regular signal x(t) at discrete time moments are specified. The general DS structure (see figure) comprises: D(z) is the transfer function of DS digital circuit; W(s) is the extrapolator's transfer
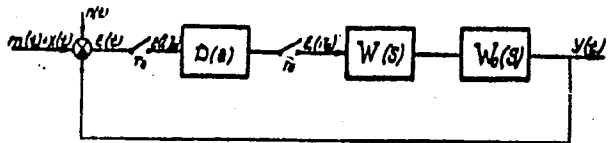
Card 1/2   UDC: 62-502

L 35883-66

ACC NR: AP6010775

function; W_o (s) is the transfer function of the DS continuous part. The mechanism of w-transform and the concept of absolute pseudo-frequency $\lambda = \frac{1}{j} \frac{2}{T_n} w$ are used which permits utilization of continuous-DS methods of analysis. Smoothing of (a) discrete white noise, (b) random noise having limited spectral density, (c) irregular tossing (rolling or pitching) type random noise, and (d) harmonic noise is considered. Orig. art. has: 3 figures and 48 formulas.

SUB CODE: 09 / SUBM DATE: 17Feb65 / ORIG REF: 003

Card 2/2

VLASOV, V.F.; KLEBANER, V.Ya., inzh., retsenzent

[Economics of metal-cutting-tool production] Ekonomika
instrumental'nogo proizvodstva. Moskva, Mashinostroenie,
1965. 135 p.   (MIRA 18:3)

GONOROVSKIY, I.S.; ITSKHOKI, Ya.S., doktor tekhn. nauk, prof.,
retsenzent; VLASOV, V.F., kand. tekhn. nauk, dots.,
retsenzent; LAPIS, A.A., kand. tekhn. nauk, dots.,
retsenzent; ZABOLOTSKIY, N.G., red.

[Radio circuits and signals] Radiotekhnicheskie tsepi i
signaly. Izd.2., ispr. Moskva, Sovetskoe radio, 1964.
694 p.
                                              (MIRA 17:11)

GONOROVSKIY, I.S.; ITSKHOKI, Ya.S., doktor tekhn. nauk, prof.,
    retsenzent; VLASOV, V.F., kand. tekhn. nauk, dots.,
    retsenzent; LAPIS, A.A., kand. tekhn. nauk, dots.,
    retsenzent; ZABOLOTSKIY, N.G., red.

[Radio circuits and signals] Radiotekhnicheskie tsepi i sig-
naly. Moskva, Sovetskoe radio, 1963. 694 p. (MIRA 17:5)

18478

USSR/Chemistry - Oxides, Reduction   1 Jun 51

"Reduction of Metal Oxides With Solid Carbon,"
P. V. Gel'd, V. G. Vlasov, N. N. Serebrennikov,
Ural Polytech Inst imeni S. M. Kirov, Sverdlovsk

"Dok Ak Nauk SSSR" Vol LXXVIII, No 4, pp 693-696

Expts for reducing chromium oxide and manganous
oxide with graphite in vacuum installation corrob-
orate existing viewpoint that reducing process
consists of 2 stages, and rate of process is detd
by 2d, slow stage, i.e., gasification of carbon
with carbon dioxide. Disproves assumption that
process is direct reaction between oxide and

18478

USSR/Chemistry - Oxides, Reduction   1 Jun 51
        (Contd)

carbon without intermediate formation of carbon
monoxide. Submitted by Acad S. I. Vol'fkovich,
2 Apr 51.

18478

GEL'D, P. V., VLASOV, V. G., SEREBRENIKOV, N. N.

GEL'D, P. V., VLASOV, V. G., SEREBRENIKOV, N. N.

Carbons

Interaction of oxides and their compounds with solid carbon. Zhur.
prikl. khim. 25, no. 2, 1952.

9. Monthly List of Russian Accessions, Library of Congress, August 1952   1953, Uncl.

VLASOV, V.G., kand.tekhn.nauk, dots.; LISNYAK, S.S., kand.tekhn.nauk

Kinetics of iron oxide reduction by means of charcoal. Izv. vys. ucheb. zav.; chern. met. no.7:45-52 Jl '58.   (MIRA 11:10)

1. Ural'skiy politekhnicheskiy institut.
    (Iron oxides)   (Oxidation-reduction reaction)   (Charcoal)

VLASOV, V.G., dots., kand.tekhn.nauk; LISNYAK, S.S., kand.tekhn.nauk

Kinetics of Fe_3O_4 and FeO reduction by solid carbon. Izv.vys.ucheb.zav.;
chern.met. no.9:45-50 S '58.   (MIRA 11:11)

1. Ural'skiy politekhnicheskiy institut.
   (Iron oxides) (Reduction, Chemical) (Carbon)

5(4)

AUTHORS: Vlasov, V. G., Kozlov, V. A.   SOV/76-32-11-23/32

TITLE: Dissociation Kinetics of Manganese Oxides (Kinetika dis-
                sotsiatsii okislov margantsa)

PERIODICAL: Zhurnal fizicheskoy khimii, 1958, Vol 32, Nr 11, pp 2608-2613
                (USSR)

ABSTRACT: Investigations of the subject mentioned in the title are of
                special interest as the dissociation processes are applied in
                metallurgy, and moreover, they are characteristic examples of
                topochemical reactions. Besides the investigations of the dis-
                sociation kinetics the authors also determined the dissociation
                pressures of MnO_2 and Mn_2O_3. MnO_2 was used in a form which
                according to the terminology by Ye. Ya. Rode (Ref 5) is called
                the β-modification of MnO_2. The experiments were carried out
                in a high-vacuum plant on a quartz spring balance. The dis-
                sociation kinetics of MnO_2 was investigated at 600-650°C and
                that of Mn_2O_3 at 400-550°C. The function of the dissociation
Card 1/3   pressure of MnO_2 versus the temperature is expressed by the

Dissociation Kinetics of Manganese Oxides

equation $\lg P_{O_2} = -\dfrac{6602}{T} + 8.21$, and that for Mn_2O_3 by

$\lg P_{O_2} = -\dfrac{11040}{T} + 8.57$. It was found that the dissociation
of both oxides at lower temperatures (400° or 600°, respective-
ly) takes place in the beginning at a constant velocity ($g=kt$).
The velocity of the process in this period is determined by
the separation of the oxygen from the oxide surface. In the
further course of the reaction this oxygen separation is
slowed down and the diffusion resistance of the layer of the
reaction products is increased. At higher temperatures the dis-
sociation processes take place according to the diffusion

equation ($g^2 = kt$), which fact is explained by an increase in
the diffusion resistance mentioned above. The character of the
dissociation processes changes on its transition into the range
where there are solid solutions, and the equation

$$\ln \frac{a}{a-g} = kt$$

Card 2/3   becomes valid. The activation energies were determined.

Dissociation Kinetics of Manganese Oxides

SOV/76-32-11-23/32

There are 2 figures, 3 tables, and 6 references, 3 of which are Soviet.

ASSOCIATION: Ural'skiy politekhnicheskiy institut im. S. M. Kirova, Sverd-
lovsk (Ural Polytechnical Institute imeni S. M. Kirov,
Sverdlovsk)

SUBMITTED: May 29, 1957

Card 3/3

5(2)

AUTHORS: Kozlov, V.A., Vlasov, V.G.

TITLE: The Kinetics of the Reduction of Manganese Oxides by Solid Carbon
              (Kinetika vosstanovleniya okislov margantsa tverdym uglerodom)

ABSTRACT: The reduction of the manganese oxides MnO_2, Mn_2O_3 and Mn_3O_4 by
              means of charcoal at relatively low temperature is studied here.
              Figure 2 shows that the reduction of MnO_2 at 400 - 550°C pro-
              ceeds only to Mn_2O_3, but at 500 and 550°C the reduction is auto-
              catalytic. The reduction of Mn_2O_3 and Mn_3O_4 proceeds to manga-
              nous oxide. The reduction rate decreases with the elimination
              of oxygen. If the contact between the reactants is very close,
              e.g., if they are mixed and ground together, the reduction rate
              increases sharply (Figure 5). The activation energy increases
              with the transition from the higher to the lower oxide (Table 3).
              It is evident that the reduction process has a diffusion charac-
              ter which is affirmed by the equation $g^2 = K\mathcal{T}$, where g is the
              degree of oxygen elimination, $\mathcal{T}$ the time since the beginning of
              the experiment and K a constant. At the transition into the

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SOV/80-32-3-10/43

The Kinetics of the Reduction of Manganese Oxides by Solid Carbon

field of solid solutions a change takes place in the character of interaction of oxides with carbon and the process of reduction may be described by the equation $\ln \dfrac{a}{a-g} = K^1 \cdot \tau$,

where a is the quantity of oxygen which must be eliminated from the reduced oxide in order to transform it completely to the lower oxide and K^1 is a constant.
There are 4 sets of graphs, 1 diagram, 3 tables, and 15 references, 9 of which are Soviet and 6 German.

ASSOCIATION: Ural'skiy politekhnicheskiy institut imeni S.M. Kirova (Ural Polytechnical Institute imeni S.M. Kirov)

SUBMITTED: October 19, 1957

Card 2/2

VLASOV, V. G

_____ (G. D)

i 7 b

PHASE I BOOK EXPLOITATION   SOV/5410

Tashkentskaya konferentsiya po mirnomu ispol'zovaniyu atomnoy
energii, Tashkent, 1959.

Trudy (Transactions of the Tashkent Conference on the Peaceful
Uses of Atomic Energy) v. 2. Tashkent, Izd-vo AN UzSSR, 1960.
449 p. Errata slip inserted. 1,500 copies printed.

Sponsoring Agency: Akademiya nauk Uzbekskoy SSR.

Responsible Ed.: S. V. Starodubtsev, Academician, Academy of
Sciences Uzbek SSR. Editorial Board: A. A. Abdullayev, Can-
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of Medical Sciences; U. A. Arifov, Academician, Academy of
Sciences Uzbek SSR; A. A. Borodulina, Candidate of Biological
Sciences; V. M. Ivashev; G. S. Ikramova; A. Ye. Kiv; Ye. M.
Lobanov, Candidate of Physics and Mathematics; A. I. Nikolayev,
Candidate of Medical Sciences; D. Nishanov, Candidate of Chemical
Sciences; A. S. Sadykov, Corresponding Member, Academy of Sciences
USSR, Academician, Academy of Sciences Uzbek SSR; Yu. N. Talanin,

Card 1/20

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Transactions of the Tashkent (Cont.)   SOV/5410

Candidate of Physics and Mathematics; Ya. Kh. Turakulov, Doctor
of Biological Sciences.   Ed.: R. I. Khamidov; Tech. Ed.: A. G.
Babakhanova.

PURPOSE : The publication is intended for scientific workers and
specialists employed in enterprises where radioactive isotopes
and nuclear radiation are used for research in chemical, geo-
logical, and technological fields.

COVERAGE: This collection of 133 articles represents the second
volume of the Transactions of the Tashkent Conference on the
Peaceful Uses of Atomic Energy. The individual articles deal
with a wide range of problems in the field of nuclear radiation,
including: production and chemical analysis of radioactive
isotopes; investigation of the kinetics of chemical reactions
by means of isotopes; application of spectral analysis for the
manufacturing of radioactive preparations; radioactive methods
for determining the content of elements in the rocks; and an
analysis of methods for obtaining pure substances. Certain

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17?

Transactions of the Tashkent (Cont.)   SOV/5410

instruments used, such as automatic regulators, flowmeters,
level gauges, and high-sensitivity gamma-relays, are described.
No personalities are mentioned. References follow individual
articles.

TABLE OF CONTENTS:

RADIOACTIVE ISOTOPES AND NUCLEAR RADIATION
IN ENGINEERING AND GEOLOGY

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Transactions of the Tashkent (Cont.)   SOV/5410

Khrushchev, V. G., A. S. Lepilin, U. Ya. Margulis, S. M. Stepanov, L. I. Belen'kiy, T. V. Bromberg, and V. G. Ivliyev. [Ministry of Health USSR]. Industrial Gamma-Plant for Sterilization of Medical Materials   170

Khrushchev, V. G., B. A. Rubin, L. V. Metlitskiy, A. I. Rytov, N. M. Gaysin, U. Ya. Margulis, V. S. Grammatikati, V. G. Vlasov, and A. V. Petrov. [Ministry of Health USSR]. Gamma-Plant for Continuous Irradiation of Potatoes   182

Prokof'yev, N. S. [Institut ekonomiki AN SSSR - Institute of Economics AS USSR]. Economic Efficiency of the Use of High-Capacity Gamma-Plants in the Light and Food Industry   192

Abdullayev, A. A., Ye. M. Lobanov, A. P. Novikov, and A. A. Khaydarov [Institute of Nuclear Physics AS UzSSR]. Use of a Multichannel Scintillation Gamma-Spectrometer for the Analysis of Rock Specimens   199

Card 10/20

S/148/60/000/007/001/015
A161/A029

AUTHORS: Vlasov, V.G., and Lebedev, A.G.

TITLE: Dissociation of Uranium Trioxide

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy - Chernaya metallur-
giya, 1960, Nr 7, pp 5-9

TEXT: Dissociation of UO_3 has been studied in a 10^{-4} Hg vacuum to in-
vestigate the kinetics and the mechanism of the process. UO_3 was prepared
by a method described in Ref 4 by heating $UO_4 \cdot 2H_2O$ for 3 hours in an
oxygen flow at $350^\circ C$ and for 1 hour at $400^\circ C$. The orange-red UO_3 could
easily be rubbed to fine powder and pressed into 1.4-1.5 g briquets.
Dissociation was studied by the decreasing weight of trioxide on spring
scales. The vacuum installation had been previously described /Ref 2/.
The process started at $420^\circ C$. Complete dissociation into U_3O_8 took place
at $550^\circ C$ in 1 hour and could not be obtained at lower temperatures
(curves, Figure 1). The dependence of the dissociation rate on the
dissociation degree was stated (curves, Figure 2). As can be seen, the

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Dissociation of Uranium Trioxide

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A161/A029

dissociation process rate was constant in the beginning, expressed by the formula: $g = kt$ where g is dissociation in %, t - time in minutes after start of experiment, k - the proportionality coefficient, until a 42%-dissociation was reached and solid phases of the summary composition $UO_{2.87}$ remained in the reaction space, where the separation of oxygen abruptly dropped to a new constant level of $g = 0.091t + 17.90$ (2). At 500°C, decomposition progressed somewhat differently (Formulae 3 and 4). At 550° it was constant until a 65%-separation of oxygen from trioxide was attained at a rate of $g = 4.65t + 40.9$ (5). If the reaction proceeded further, the rate dropped to

$$lg\frac{g}{100 - g} = 0.0608t. \quad (6)$$

The constant reaction rate in the beginning may be explained by a high number of defective spots caused by crushing before briquetting, and by the beginning of the dissociation on these spots, where oxygen was re-moved from the surface by chance law. Later the active centers dis-appeared. The abrupt change in the rate after the 42% dissociation point at 540°C can be explained on the basis of the structural diagram of the U - O system /Ref 3/. According to this diagram the dissociation of UO_3

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Dissociation of Uranium Trioxide

S/148/60/000/007/001/015
A161/A029

in the beginning proceeds without producing a new solid phase in connection with the existence of the region of solid solutions, the oxygen content of which is only reduced. At $500°C$, higher temperature caused a faster disappearance of active centers and apparent growth of diffusion resistance in the layer of the forming reaction products. At $550°C$ dissociation can be described by equation (6). The apparent activation energy in the beginning stage (to 30% oxygen separation) has been calculated as 37.2 kcal/mol, which well agrees with the reaction heat effect value of $6UO_3 = 2U_3O_8 + O_2$ determined by Brewer /Ref 5/ to be 35 kcal/mol and confirms the opinion of S.Z. Roginskiy /Ref 6/ that the activation energy of the majority of topochemical reactions in conditions far from equilibrium is approximately equal to the heat effect. There are 2 figures and 6 references: 5 are Soviet and 1 English.

ASSOCIATION: Ural'skiy politekhnicheskiy institut (Ural Polytechnic Institute)

SUBMITTED: July 14, 1959

Card 3/3

VOROSHIN, Ye.M.; VLASOV, V.G.

Spectrographic study of phenol acids. Part 1: Hydroxybenzoic acids.
Zhur. ob. khim. 30 no.9:3004-3011 S '60.
                                                              (MIRA 13:9)

1. Khar'kovskiy farmatsevticheskiy institut.
                (Benzoic acid—Spectra)

AUTHORS: Vlasov, V.G., Kozlov, V.A.   S/080/60/033/04/02/045

TITLE: The Interaction of Uranium Trioxide With Solid Carbon

PERIODICAL: Zhurnal prikladnoy khimii, 1960, Vol 33, Nr 4, pp 760 - 765

TEXT: The rate of the process of direct reduction of uranium trioxide was in-
vestigated. Uranium trioxide was obtained by heating uranium peroxide for 6 hours in
an oxygen flow at 400°C. The reducing agents were birch charcoal and sugar charcoal
with a carbon content of 99.99%. The investigation was carried out in a high-vacuum
installation with continuous control of the weight loss of the sample by means of
spring scales. Reduction by birch charcoal was studied within the temperature range
350 - 400°C, and by sugar charcoal within the range 450 - 530°C. Birch charcoal proved
to be the more active reducing agent. The activation energy of the reduction process
in the case of birch charcoal was 43 kcal/mole and in the case of sugar charcoal
65 kcal/mole. The gaseous phase formed during reduction consisted only of carbon dioxide.
The authors try to explain the mechanism of accelerating the reaction of carbon monoxide
regeneration, which is the slowest stage in the process of direct reduction of uranium
trioxide. There are: 4 graphs and 16 references, 10 of which are Soviet and 6 German.

SUBMITTED: August 24, 1959

Card 1/1

S/020/60/134/006/022/03?
B004/B054

AUTHORS: Vlasov, V. G. and Strekalovskiy, V. N.

TITLE: Interaction Between Hydrogen and Uranium Trioxide

PERIODICAL: Doklady Akademii nauk SSSR, 1960, Vol. 134, No. 6,
               pp. 1384-1386

TEXT: The authors give a report on their investigation of the reduction
of uranium trioxide by hydrogen in the temperature range from 300 to
$500^\circ C$ and at a hydrogen pressure of 50 - 400 torr. The experiments were
made in a vacuum apparatus, and the loss in weight of UO_3 was measured by
a spring balance. The experimental data are shown in diagrams; Fig. 1:
degree of reduction as a function of time at different temperatures and
P_{H_2} = 200 torr; Fig. 2: degree of reduction as a function of time at dif-
ferent P_{H_2} and $400^\circ C$; Fig. 3: reaction rate as a function of the degree
of reduction at different temperatures; and Fig. 4: reaction rate as a
function of the degree of reduction at different P_{H_2}. Table 1 shows the

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Interaction Between Hydrogen and Uranium
Trioxide   S/020/60/134/006/022/03!
                                            B004/B054

ratio O : U for P_{H_2} = 200 torr after two hours of heating to 350°, 400°,
450°, and 500°C. These results are interpreted on the basis of the phase
diagram of the U - O system. The first horizontal sections of the curves
in Figs. 3 and 4 correspond to the reduction of UO_3 to U_3O_8. Here, the
limiting stage is the reaction of hydrogen adsorbed on the oxide surface
with the oxygen of the oxide. This reaction follows equation (1):
$V = kP_{H_2}^{1/2}$. The hydrogen is rapidly adsorbed in the atomic state. As the
authors had proved in a previous paper (Ref. 1) that UO_3 dissociates in
vacuo only above 430°C, while reduction starts already at 350°C, the latter
proceeds without previous dissociation. The curve sections in which the
reaction rate decreases with increasing degree of reduction correspond to
the continuous transition of U_3O_8 into the phase $UO_{2.6+x}$ with the minimum
oxygen content corresponding to the given temperature. The decrease in
the reaction rate is explained by a reduction of the oxygen content in
the solid phase. The second horizontal sections of the curves in Figs. 3
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Interaction Between Hydrogen and Uranium
Trioxide

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B004/B054

and 4 correspond to the reduction of $UO_{2.6\pm x}$ to the tetragonal phase.
Here, the limiting stage is the hydrogen adsorption on the oxide surface
according to equation (2): $V = k_1 P_{H_2}$. No reduction to $UO_{2.0}$ occurred in
the temperature range investigated. The authors mention a paper by F. F.
Vol'kenshteyn (Ref. 3). There are 4 figures, 1 table, and 4 references:
3 Soviet and 1 Swedish.

ASSOCIATION: Ural'skiy politekhnicheskiy institut im. S. M. Kirova
               (Ural Polytechnic Institute imeni S. M. Kirov)

PRESENTED: June 11, 1960, by V. I. Spitsyn, Academician

SUBMITTED: June 8, 1960

Card 3/3

26.2230

21220

S/126/61/011/003/007/017
E193/E483

AUTHORS: Strekalovskiy, V.N., Bessonov, A.F., Vlasov, V.G. and
             Sidorenko, F.A.

TITLE: Phase Transformations During Reduction and Oxydation
             of Uranium Oxides

PERIODICAL: Fizika metallov i metallovedeniye, 1961, Vol.11, No.3,
             pp.400-403 + 1 plate

TEXT: The uranium-oxygen system has lately attracted a great
deal of attention owing to the possibility of using uranium
oxides (dioxide in particular) in the manufacture of ceramic fuel
elements.   However, the experimental work has been mainly
confined to studies of oxydation or thermal decomposition of
uranium oxides, and the object of the present investigation was to
study (a) the kinetics of hydrogen reduction of amorphous UO_3
and green U_3O_8 at 300 to 700°C,   (b) the process of oxydation of
UO_2 in air, oxygen and CO_2 at 165 to 860°C and (c) the phase
transformations taking place during these reactions.   The results
of the study of kinetics of the reduction process are reproduced
schematically in Fig.1, where the rate of reduction (A in
arbitrary units) is plotted against the overall composition of the

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Phase Transformations ...

resultant product, i.e. against the oxygen/uranium (O/U) ratio.
It is pointed out, in this connection, that neither the rates
of reduction of UO_3 and UO_8, nor the energy barriers during the
crystallo-chemical transformations of these oxides are the same;
thus, for instance, hydrogen reduction of UO_3 begins at 350°C, the
corresponding temperature for UO_8 being 450°C. In addition,
reduction of UO_3 at temperatures < 500°C practically ceases when
the oxide reaches the oxide content corresponding to $UO_{2.33}$; at
higher temperatures, U_4O_9 and oxides with a still lower oxygen
content are produced. The results of the kinetic studies were
correlated with the results of X-ray diffraction analysis of the
products of the reduction of U_3O_8, and the following conclusions
were reached regarding the phase transformations, taking place
during the reduction process. In the initial stages, U_3O_8
gradually loses its oxygen, this process continuing until the
starting material is reduced to 46.9% (100% reduction corresponding
to complete conversion of UO_3 to UO_2) which corresponds to the
overall composition of the product given by the formula $UO_{2.539}$;
at this stage, the X-ray diffraction pattern still shows the
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Phase Transformations ...

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lines of the U_3O_8 phase; the lattice parameters of the initial phase have changed but no lines of a new phase have yet appeared; at 62 and 69% reduction, the lines of the starting oxide are still present in the X-ray pattern and lines of the cubic U_4O_7 phase appear; at 75% reduction, the U_3O_8 lines completely disappear and only the U_4O_7 lines remain; after a further decrease in the oxygen content, the crystal structure of the oxide remains cubic but the lattice parameter increases. Reduction of UO_3 takes place in a similar manner, the crystalline U_3O_8 phase being formed directly from the amorphous UO_3 which does not pass through the crystalline form during this process. The whole reduction process can be represented in the following manner:
Amorphous $UO_3 \Rightarrow$ Solid solution, based on $UO_{2.67} \Rightarrow UO_{2.2} \Rightarrow UO_{2 + x}$.
Regarding the process of oxydation of UO_2 in air or in oxygen, it can be represented by:
$UO_2 \rightarrow UO_{2 + x} \Rightarrow UO_{2.36 + 0.05} \rightarrow$ Solid solution, based on $UO_{2.67}$.
The tetragonal phases ($UO_{2.32 + 0.01}$, $UO_{2.35}$, $UO_{2.37}$, $UO_{2.41}$) whose presence can be inferred from the kinetics of the process studied, are unstable and decompose to form U_4O_9 and U_3O_8. When
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the oxydation reaction takes place (in air or oxygen) at
temperatures $\geqslant 400°C$, no formation of the tetragonal phases occurs,
and the process proceeds according to:
$UO_2 \longrightarrow UO_{2+x} \longrightarrow UO_{2.25} \longrightarrow$ Solid solution, based on $UO_{2.67}$.
Finally, it was established that UO_2 does not oxidize in carbon
dioxide.   There are 3 figures and 12 references: 8 Soviet and
4 non-Soviet.

ASSOCIATION: Ural'skiy politekhnicheskiy institut im. S.M.Kirova
             (Ural Polytechnical Institute imeni S.M.Kirov)

SUBMITTED: July 18, 1960

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Phase Transformations ...

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Fig.1.
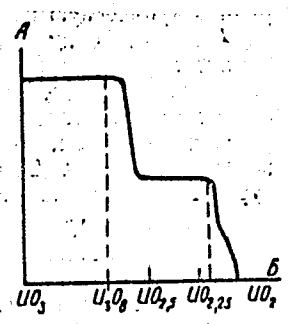
Card 5/5

24484
S/126/61/011/006/010/011
E193/E483

21.2100   24.7300

AUTHORS: Bessonov, A.F. and Vlasov, V.G.

TITLE: Phase transformations during oxidation of metallic
uranium

PERIODICAL: Fizika metallov i metallovedeniye, 1961, Vol.11, No.6,
pp.957-959

TEXT: The object of the present investigation was to study
oxidation of uranium in air and carbon dioxide.   To this end,
specimens (4 x 2 x 15 mm) were degreased, pickled in concentrated
HNO_3, washed in alcohol and held for 15 minutes in air at various
temperatures between 20 and 350°C, or in CO_2 at 400 to 900°C, after
which the surface of the specimens were examined by X-ray
diffraction.   The results are reproduced in Fig.1, showing the
X-ray diffraction pattern of the surface of uranium specimens after
(a) 8 days exposure to air at room temperature,   (6) oxidation at
100°C,   (B) oxidation at 205°C,   (2) oxidation at 300°C,
(3) oxidation at 350°C, (e) removal of the outer, loose, oxide
layer.   An X-ray diffraction pattern of uranium, oxidized in CO_2
is reproduced in the paper.   The following conclusions were reached.
1) The phase transformations taking place during oxidation of
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Phase transformations ...

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uranium in air at 265 to 400°C can be represented by:

$U_{metal} \to \alpha\ UO_2 \to \alpha\ UO_{2+x} \to \beta\ UO_2 \to U_3O_7 \to$ solid solutions based on $UO_{2.67}$.
2) The constitution diagram of the U-O system is repeated in the
phases which constitute the consecutive oxide layers of scale,
formed on uranium in air at atmospheric pressure in the temperature
interval studied.   3) Metallic uranium, heated in CO_2, oxidizes to
UO_2 only.   There are 2 figures and 8 references: 7 Soviet-bloc and
1 non-Soviet-bloc.   The reference to an English language
publication reads as follows: Blackburn P., Weissbart J.,
Gulbransen E., J.Phys.chem., 1958, 62, 8.

ASSOCIATION: Ural'skiy politekhnicheskiy institut im. S.M.Kirova
            (Ural Polytechnical Institute imeni S.M.Kirov)
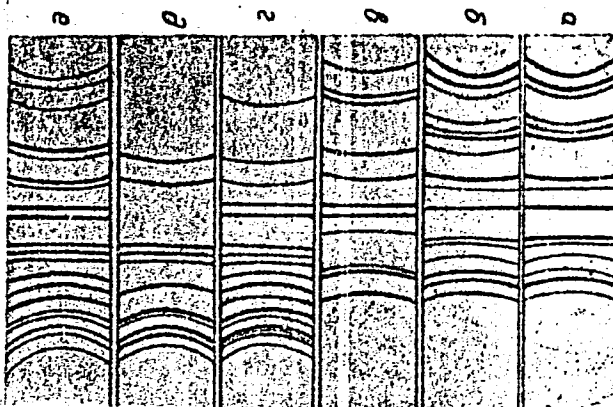
SUBMITTED: December 15, 1960

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Phase transformations ...

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Fig.1.

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24485
S/126/61/011/006/011/011
E073/E335

7/.2/0 0

AUTHORS: Bessonov, A.F., Borisov, B.S. and Vlasov, V.G.

TITLE: Investigation of the Structure of the Primary Oxide Film on Uranium

PERIODICAL: Fizika metallov i metallovedcniye, 1961, Vol. 11, No. 6, pp. 959 - 960

TEXT: In studying the mechanism of oxidation of metals investigation of the structure of the primary oxide film formed in air at room temperature during the initial oxidation period is of great importance. For some metals the structure of the films formed during the initial period of oxidation does not differ from those formed during later stages of oxidation. For a number of other metals, for instance, iron and its alloys, a film of a particular structure (type $j-Fe_2O_3$) forms during the initial period of oxidation. The primary oxide film is a protective one for most metals; it grows to some limit thickness, then stops growing and prevents further oxidation. The kinetics of growth of the primary films depends on a

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Investigation of the Structure ...   S/126/61/011/006/011/011
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number of factors and so far no satisfactory theory on this process exists. The authors carried out investigations on uranium of 99.8% purity which, after rolling, was annealed at 850 °C for six hours in vacuum. Plate specimens 10 x 5 x 3 mm were initially ground with emery paper of varying coarseness and lapped by a ring using high-grade alumina. After polishing the ring was moistened with benzol or ethyl alcohol to prevent access of air to the polished surface. Microscopic investigations have shown that the surface was peppered with fine crystals and the number and size of the crystals increased rapidly. For determining the structure of this primary film electron-diffraction studies were made. For removing the scale films the specimens were etched in nitric acid for 10 min and then washed several times in ethyl alcohol. Oxidation was in air at room temperature for durations of 10, 30, 120 and 240 min. In the second series of experiments, the specimen, after having been taken out of the alcohol (wet), was placed immediately into the chamber of the electron-diffraction

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E073/E335

Investigation of the Structure ....

apparatus from which the air was evacuated so that the specimen surface interacted only with the air which remained in the chamber of the electron-diffraction camera. Part of the specimens were subjected to electron-diffraction investigations immediately after polishing (without etching); back reflection pictures were taken. The obtained interplane distances were compared with X-ray data, obtained by the powder method for uranium oxides. The investigations revealed a cubic phase on uranium oxide with a lattic constant of a = 5Å5 Å for all the specimens, which corresponds to the oxide UO_2. In a second series of experiments the electron-diffraction patterns contained reflexes from the metallic uranium in addition to lines of the phase UO_2.

This indicates that in this case the entire thickness of the oxide film participated in the diffraction and that the primary oxide film of uranium consists solely of the phase UO_2. From the widening of the Debye lines the size of the forming UO_2 crystals could be determined, which was about 10^{-4} cm. Thus,

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the microscopic and electron-diffraction investigation of oxide films of uranium obtained on oxidation of the latter in air at room temperature indicates that the primary film on uranium is crystalline and consists solely of UO_2.

(Abstractor's note: this is a complete translation.)
There are 2 Soviet references.

ASSOCIATION: Ural'skiy politekhnicheskiy institut
                 im. S.M. Kirova (Ural Polytechnical Institute
                 im. S.M. Kirov)

SUBMITTED: January 13, 1961

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S/126/61/012/003/011/021
E193/E135

AUTHORS: Bessonov, A.F., and Vlasov, V.G.

TITLE: Concerning the mechanism of oxydation of
             metallic uranium

PERIODICAL: Fizika metallov i metallovedeniye, vol.12, no.3, 1961,
             403-408

TEXT: Effective measures against oxydation during the
preparation of metals or in service can be applied only if the
mechanism of this process is properly understood. Hence the
present investigation, in which the kinetics of oxydation of
uranium were studied by the gravimetric method and the
constitution of the scale formed on uranium under various
conditions was determined by X-ray diffraction, microscopic, and
electron diffraction analyses. The experiments were carried out
on 99.8% pure uranium specimens, degreased, pickled in concentrated
HNO_3, and washed in ethyl alcohol. The oxydation tests were
carried out in dry air and oxygen at various temperatures and
pressures; some results are reproduced graphically. In Fig.1
the specific increase in weight ($\Delta m/s \times 10^4$, mg/cm^2) of uranium

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heated in air is plotted against time (minutes), curves 1-6
relating to tests conducted at 250, 300, 350, 400, 600 and 760 °C
respectively. The kinetics of oxydation of uranium in oxygen are
illustrated in the same manner in Fig.2, where curves 1-4 relate
to results obtained at 250, 300, 350 and 400 °C. It was
established that the effect of pressure (p, mm Hg) on the rate of
oxydation (v, mg/cm^2) in minutes of uranium in air at 400 °C is
described by

$$v = a_1 \sqrt{p} \qquad\qquad (3)$$

for pressures higher than 200 mm Hg, and by

$$v = a_2 p \qquad\qquad (4)$$

for pressures lower than 200 mm Hg. The oxydation rate of
uranium in oxygen at 300 °C under pressures ranging from 5 to
550 mm Hg is given by $v = a_3 \sqrt{p}$.

The rate of oxydation was not affected at all by forced
circulation of oxygen and only to a small extent by circulation of
air at pressures > 200 mm Hg; at p < 200 mm Hg forced
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circulation of air increased the oxydation rate, this effect becoming more pronounced at higher temperatures. The activation energy of the process studied was 18 and 4.6 kcal/mol, when the reaction took place in air below and above 400 °C, respectively, and 17 kcal/mol for oxydation in oxygen below 400 °C. The oxide film formed on uranium in air at room temperature had a crystalline structure and consisted exclusively of UO_2. The constitution of scale formed on uranium in air at 260-400 °C was determined by the present authors in an earlier investigation: the composition of the consecutive layers starting from metallic titanium (U_{met}) is

$$U_{(met)} \rightarrow \alpha\ UO_2 \rightarrow \alpha\ UO_{2+x} \rightarrow \beta\ UO_2(U_4O_9) \rightarrow U_3O_7 \rightarrow U_3O_8$$
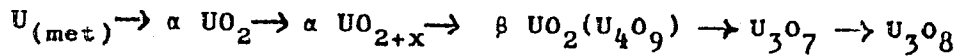
Although the molecular volume, U_o, of uranium oxide is larger than the atomic volume, U_m, of uranium, the oxide scale formed on this metal does not protect it from further oxydation. This is attributed by the present authors to the coarsely-crystalline nature of the oxide film formed at room temperature, and also to the fact that large internal stresses are set up in the oxide film

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Concerning the mechanism of oxydation ... S/126/61/012/003/011/021
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owing to the large difference between the specific volumes of the
uranium oxide and uranium whose ratio varies between 1.9 and 2.6.
To determine the relative roles played in the oxydation of
uranium by the diffusion of oxygen and metal, tests were carried
out in air at 350 °C on specimens fitted with inert platinum
markers in the form of 0.02 mm thick wire; irrespective of the
duration of the test, the platinum marker remained on the surface
of the oxide scale. The results of the present investigation are
discussed in relation to various published data and it is
concluded that diffusion of oxygen through the dense triplex
$\alpha UO_2 \rightarrow \alpha UO_{2+x} \rightarrow \beta UO_2(U_4O_9)$ layer of oxides with a cubic crystal
lattice which adheres strongly to uranium, governs the kinetics of
oxydation of uranium. There are 4 figures and 15 references:
10 Soviet-bloc and 5 non-Soviet-bloc. The English language
references read as follows:

Ref.5: N.B. Pilling, R.E. Bedworth. Inst. Met., 529, Vol.29, 1923.
Ref.7: P. Blackburn, I. Weissbart, E.I. Gulbransen. Phys. Chem.,
       1958, Vol.62, 8.
Ref.10: F.I. Gronvold, Inorg. Nucl. Chem., 1955, Vol.1, 357.

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Concerning the mechanism of oxydation... S/126/61/012/003/011/021
E193/E135

ASSOCIATION: Ural'skiy politekhnicheskiy institut im. S.M. Kirova
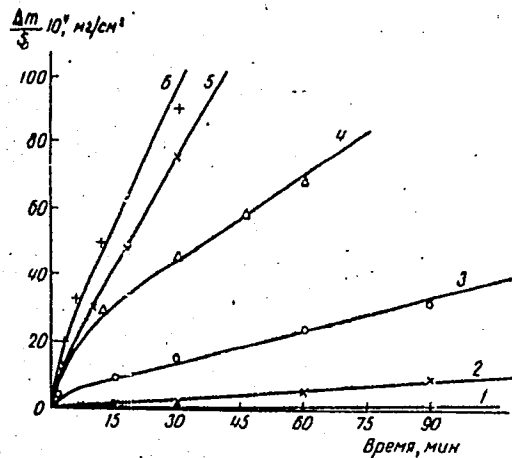(Ural Polytechnical Institute imeni S.M. Kirov)

SUBMITTED: February 6, 1961

Fig.1

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BESSONOV, A.F.; VLASOV, V.G.

    Interaction of uranium metal with carbon dioxide. Fiz. met. i
metalloved. 12 no.5:775-778 N '61.   (MIRA 14:12)

    1. Ural'skiy politekhnicheskiy institut imeni S.M.Korova.
                (Uranium---Metallography)
                (Carbon dioxide)

21.1330

AUTHORS: Vlasov, V.G., and Shalaginov, V.N.

TITLE: Reduction of Uranium Trioxide by Carbon Monoxide

TEXT: Indirect reduction of higher uranium oxides by carbon monoxide is important in the technology of uranium metal, since uranium oxide with a very clean surface can be obtained. Only one note exists in literature by D. Katz and E. Rabinowich (Ref.1: The Chemistry of Uranium, National Nuclear Energy Series) stating that uranium trioxide (but not U_3O_8) is quickly reduced by CO at $350^\circ C$. The purpose of the present study was to determine the reduction kinetics of uranium trioxide in CO gas. Amorphous uranium trioxide powder, prepared by heating $UO_4 \cdot nH_2O$ in oxygen (6 hrs at $400^\circ C$) and carbon monoxide obtained by decomposing formic acid with sulfuric acid, were used in the experiments. Investigations were carried out in a high-vacuum apparatus (pressure 10^{-4} torr) containing a quartz microbalance to control continuously the loss in weight of the uranium trioxide sample. At $250^\circ C$

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Reduction of Uranium Trioxide by Carbon Monoxide A057/A129

and p_{CO} = 200 torr in 5 hrs no considerable reduction of UO_3 by CO takes place, while above 400°C the reduction is too fast to be controlled. Thus two series of experiments were carried out - one with an initial CO pressure (p_{CO}) of 200 torr at temperatures from 260°-400°C to investigate the effect of temperature, and the other series at 300° and 400°C changing p_{CO} from 15 to 400 torr to determine the effect of CO pressure. The obtained rate curves for the first series are given in Fig.2,3 and for the second in Fig. 4,5. Activation energies were calculated and the following results obtained:

Degree of reduction in %   6   33   60   75
apparent activation energy
in kcal/mole   30.7   30.7   23.3   25.3

Fig.2 shows that the maximum reduction rate is observed at 20-28% of reduction. With rising temperature a shift of the maximum towards higher degrees of reduction is observed. The rate curves in Fig.4 and 5 indicate the dependence of total reduction rate (v) on the initial pressure of CO (p_{CO}). At a given degree of reduction and at constant temperature $v = K \cdot p_{CO}$, where the coefficient K is a function of the temperature and degree of reduction (Fig. 6). The results of the present paper demonstrate that reduction of UO_3 by CO occurs easily at 300°C. Since UO_3 dissociates in high vacuum above 420°C,

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dissociation cannot be an intermediate state in the indirect reduction of UO_3.
The best explanation of the present results can be given on the basis of the
adsorption-catalytic theory of reduction of metal oxides by G.I. Chufarov and
Ye.P. Tatiyevskaya [Ref.7: "Problemy metallurgii" ("Problems in Metallurgy")
Izd. AN SSSR (Ed. AS USSR) (1953), or Ref.8: "Fiziko-khimicheskiye osnovy
domennogo proizvodstva i sovremennaya praktika proizvodstva chuguna" ("Phys-
ico-Chemical Principles in the Blast-Furnace Production and Modern Practice
of the Cast Iron Production") Sverdlovsk (1955)]. The different stable and
non-stable phases of the system uranium-oxygen have to be considered simul-
taneously. G. Brauer [Ref.2: "Rukovodstvo po preparativnoy neorganicheskoy
khimii" ("Manual of the Preparative Inorganic Chemistry") IL, M (1956)] as-
sumes that the composition of amorphous uranium trioxide can change continu-
ously until the formation of $UO_{2.92}$. Then formation of U_3O_8 starts. In the
present investigations reduction $UO_3 \longrightarrow UO_{2.92}$ occurred with constant rate,
i.e., under kinetic conditions. In this step there was no formation of a new
phase, hence the limiting stage is the surface reaction between carbon mon-
oxide (adsorbed on uranium oxide) and oxygen of the uranium oxide. This
proves the observed dependence of the total reduction rate on the initial
carbon monoxide pressure. The rate of surface reaction is independent of the

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Reduction of Uranium Trioxide by Carbon Monoxide A057/A129

degree of oxygen removal apparently due to some factors like the formation of defect places and low diffusion resistance. With the formation of the new phase $UO_{2.92}$ crystallo-chemical transformations start between the new and the old phase, i.e., the phase boundary catalyzes the process and autocatalysis occurs. Rate curves in Fig.3-5 decrease until $UO_{2.55}$ is formed. The latter is the lower limit of the U_3O_8 phase according to G. Hoekstra and S. Sie-gel [Ref.9: Reports of the 1st International Conference on the Peaceful Uses of Atomic Energy, in Geneve, VII,483 (1957)]. In the next reduction stage the new phase $U_4O_9(UO_{2.25})$ is formed, i.e., change in reduction degree from 45 to 75% occurs: $UO_{2.55} + CO \longrightarrow UO_{2.25} + CO_2$ under kinetic conditions. Then in step $UO_{2.25} \longrightarrow UO_{2+x} \longrightarrow UO_2$, i.e., change in degree of reduction from 75 to 100%, oxygen is introduced into the cubic dioxide lattice according to Ref.9 and Ref.11: R. Willardson, I. Moody, H. Gocring, J. Inorg.Nuclear Ch., 6,1, 19-33 (1958), and Ref.12: A. Arrot, I. Goldman, Phys.Rev., 108,4,948-953 (1957), disordered in the first and ordered in the second stage. The slowest stage is the oxygen diffusion into the solid phase and herewith stage $UO_{2.25}$ $\longrightarrow UO_2$ is a diffusion-controlled process. This statement corresponds with the present experimental data. Briefly, the whole investigated process oc-curs: from UO_3 to $UO_{2.92}$ with a rate independent of the reduction degree,

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S/080/61/034/001/003/020

Reduction of Uranium Trioxide by Carbon Monoxide A057/A129

from $UO_{2.92}$ to $UO_{2.55}$ autocatalytically, from $UO_{2.55}$ to $UO_{2.25}$ again with constant rate and from $UO_{2.25}$ to UO_2 with a rate decreasing with increasing degree of reduction. There are 6 figures and 12 references: 7 Soviet-bloc and 5 non-Soviet-bloc.

SUBMITTED: June 15, 1960

Card 5/10

22523
S/080/61/034/001/004/020
A057/A129

21 1330

AUTHORS: Strekalovskiy, V.N., Vlasov, V.G.

TITLE: Kinetics of Reduction of Uranium Trioxide by Hydrogen

PERIODICAL: Zhurnal Prikladnoy Khimii, 1961, Vol. 34, No. 1, pp. 32-38

TEXT: The purpose of the present investigation was to extend the knowledge of the mechanism of indirect reduction of metal oxides, in particular of the kinetics and mechanism of uranium trioxide reduction with hydrogen gas. Since indirect reduction of UO_3 is thermodynamically possible until UO_2 only, the part between UO_3 and UO_2 of the uranium - oxygen phase diagram was of interest. Reduction of UO_3 to UO_2 is important for uranium production [Ref.1, G.A. Meyerson, Atomnaya energiya, 7,2 129 (1959)], but literature contains only information on the preparation of UO_2 with particular properties [Ref.2, D. Katz, E. Rabinowitch, Chemistry of Uranium, N.N.E.S.; Ref.3, G. Seaborg, D. Katz, The Actinides, N.N.E.S.; Ref.4, D. Vaughan, I. Briedge, A. Allison, C. Shvartz, Ind.Eng.Chem., 49,10,1699-1700 (1958); Ref.7, I. Maly, H. Landspersky, Iaderna Energie, 4,1,9-18 (1958)] and no data are given on the whole Card 1/10

Kinetics of Reduction of Uranium Trioxide by Hydrogen

mechanism and kinetics of this process. In the present paper experimental results on the reduction of UO_3 by hadrogen at temperatures of 350°-$500^\circ C$ and hydrogen pressures of 50-400 torr are given. The used amorphous UO_3 powder was prepared by heating $UO_4 \cdot nH_2O$ in an oxygen stream at $350^\circ C$ during 5 hrs with final heating at $400^\circ C$ for 1 hr. The investigations were carried out in a high-vacuum circulation apparatus with a tungsten spring balance. Hydrogen was circulating through the system continuously, while temperature was re-gulated by an electronic ЭПВ--01 (EPV-01) thermoregulator and controlled by a ПП (PP) bridge. From the experimental data "reduction degree versus time" curves were plotted (Fig.2-3). Two series of experiments were made: one at temperatures from 300°-$500^\circ C$ and a hydrogen pressure of 200 torr, the other at $400^\circ C$ and pressures from 50 to 400 torr. The dependence of the reduction rate on the reduction degree (Fig.4,5) indicates that in the beginning of the process at hydrogen pressures from 100 to 400 torr the dependence of the re-duction rate (v) on the hydrogen pressure (p_{H_2}) at constant temperature can be expressed by $v = k \cdot p_{H_2}^{1/2}$. This was also observed in investigations into

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Kinetics of Reduction of Uranium Trioxide by Hydrogen

reaction kinetics of lead-, cadmium- and tin-oxides in hydrogen [Ref.13:
G. Björling, Svensk.Kem.Tidskrift, 67,6-7,319 (1955)]. The apparent activa-
tion energy for this reduction stage (first horizontal part of the curves in
Fig.4,5) was calculated with 20.8 kcal/mole. The second reduction stage re-
presents a sharp decrease in reduction rate. In this step the total compo-
sition of the solid phases does not change essentially (see Tab.1). The de-
crease in reduction rate is apparently due to the decrease in oxygen concen-
tration in the solid phase. It is possible that a simultaneous decrease of
hydrogen adsorption occurs. Hence the total rate of reduction decreases. In
the last stage of reduction the reaction rate is constant again (except the
rate curve for 500°C and p_{H_2} = 200 torr) and is expressed by $v = k_1 \cdot p_{H_2}$. At
400° and 450°C these horizontal parts of reduction curves (Fig.4) correspond
to the reduction of $UO_{2.6\pm x}$ phase until the tetragonal phase. For this stage
(70% reduction) the activation energy is 30 kcal/mole. The composition of
reaction products (Tab.2) demonstrates that reduction did not proceed until
formation of UO_2, only at 500°C reduction went further than U_4O_9. The reason
why on the curve for 500°C (Fig.4) reduction from UO_3 to $UO_{2.47}$ occurs with

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Kinetics of Reduction of Uranium Trioxide by Hydrogen

constant rate must be explained by additional investigations. Katz and Rabi-
nowitch (Ref.2) stated that amorphous UO_3 crystallizes when stored for a long
time. In the present investigations amorphous UO_3 was stored for 1.5 years
and another sample was heated at 400°C and no crystallization was observed.
Thus in the present work amorphous UO_3 was reduced. Dissociation of UO_3 oc-
curs above 430°C [Ref.12: Biltz, W., Müller, H. Z.anorg.Chem.,163,258 (1927)],
thus in the present investigations UO_3 did not dissociate. The obtained re-
sults indicate that reduction of amorphous UO_3 with hydrogen until formation
of U_3O_8 is controlled by the surface reaction between adsorbed hydrogen and
the oxygen of the oxide. Adsorption occurs with sufficient high rate, reac-
tion equilibrium is formed and the adsorption isotherm can be expressed by
$a = k' \cdot p_{H_2}^{1/2}$ (a = hydrogen concentration on the surface of the oxide, 1/2 means
that H_2 hydrogen is dissociated to atoms - according to Ref.17, F.F. Vol'-
kenshteyn, Usp.fiz.nauk, 50,2,257 (1956) . P.W. Jacobs, F.S. Tompkins, Chem-
istry of the Solid State, Bullerworth,chap.7, London (1955) (Ref.18) stated
that the surface reaction is developing with a constant rate. This is in ac-
cordance with the present results, since in all cases reduction from UO_3 to
Card 4/10

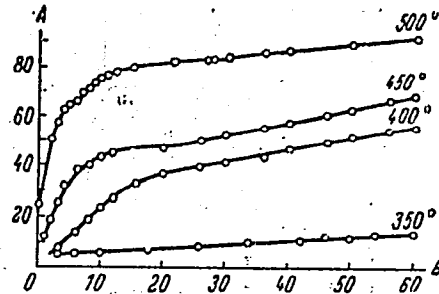Kinetics of Reduction of Uranium Trioxide by Hydrogen

U_3O_8 occurred at constant rate. There are 5 figures, 2 tables, and 18 references: 9 Soviet-bloc and 9 non-Soviet-bloc.

SUBMITTED: April 7, 1960

Figure 2:

Dependence of the degree of reduction on time at different temperatures (p_{H_2} = 200 torr)

A - degree of reduction in %
B - time in min (valid also
    for Fig.3)

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VLASOV, V.G.; SHALAGINOV, V.N.

Effect of alkali metal carbonate additions on the kinetics of uranium trioxide reduction with carbon monoxide. Kin. i kat. 5 no.2:263-267 Mr-Ap '64.   (MIRA 17:8)

1. Ural'skiy politekhnicheskiy institut imeni Kirova.

CITED SOURCE:

L 35 2-

ACCESSION NR: AP 003890

Optimum time for polymerization of the scintillators in 5-10 l volumes was estab-

160 kg. (See ref). Zhur. Anal., 1964, 8S378). L. Kotlyarevskaya.

SUB CODE: OC, MT   ENCL: 00

L 31834-65   ENG(j)/EWA(h)/EWP( )   /EWA(1   /Peb   RM
ACCESSION NR: AR5005651   S/ .58/64/000/012/A039/A039

SOURCE: Ref. zh. Fizika, Abs. 12A361

AUTHORS: Nagornaya, L. L.; Bezuglyy, V. D.; Vlasov, V. G.

TITLE: Investigation of the stability of plastic scintillators
based on polystyrene

CITED SOURCE: Sb. Stsintillyatory i stsintillyats. materialy. Vyp.
3. Khar'kov, Khar'kovsk. un-t, 1963, 85-90

TOPIC TAGS: plastic scintillator, scintillation efficiency, scin-
tillator aging, polystyrene,

TRANSLATION: The authors investigated the effect produced on aging
of plastic scintillators (PS) by different factors, such as the
temperature, humidity, natural elimination, etc. In addition, in
order to develop optimal technological conditions for the manufac-

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ACCESSION NR: AR5005651   0

ture of PS, a study was made of the stability of PS in time. The
PS were prepared by polymerization of styrene with additives of PPP
(2%) and POPOP (0.06%) at T = 200, 170, 140, 125° and durations (t)
of 100, 70, 50, 32, 24, 16, and 8 hours. Standard samples 18 mm
in diameter and 15 mm high were tested. The relative scintillation
efficiency was determined from the average photocurrent of an FEU-29
photomultiplier irradiated by a radioactive source Ag^{110}. After
plotting the indices, the samples were stored under different condi-
tions: without exposure to light at T = 0, 20--25, ~ 40, 60--70°,
natural elimination at T = 70°, and also at increased humidity.
The observations were carried out for 1.5--2.5 years, with the sample
inspected visually and measured every six months. It was established
that it is necessary to ensure minimum content of the residual mono-
mer in the PS. The best PS were those manufactured at T = 170--180°
and t = 32 hours, for blocks 20 mm in diameter (t increases with
increasing dimensions). The scintillation efficiency during 2.5
years, in the absence of light, at T = 20--40°, and also under con-

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L 31834-65
ACCESSION NR: AR5005651   𝒪

ditions of increased humidity, wa⌐ 85%.   It is impossible to subject
PS to multiple abrupt temperature fluctuations (RZhKhim, 1964, 38378).
L. Kotlyarevskaya.

SUB CODE: OP, OC   ENCL: 00

Card 3/3

21,1330

AUTHORS: Strekalovskiy, V.N., Vlasov, V.G.

TITLE: Reduction of U_3O_8 by Hydrogen

TEXT: The present work is a kinetic study of the reduction of U_3O_8 by hydro-
gen gas at $450°-700°C$ and hydrogen pressures of 20-400 torr. Reduction of
U_3O_8 in hydrogen is used in uranium technology, and for the preparation of
$UO_{2.00}$ or U_4O_9. Kinetics and mechanism of this process were studied insuf-
ficiently until now. The opinion of some American investigators (Ref.2:
D. Katz and E. Rabinowitch, The Chemistry of Uranium, N.N.E.S., Div. VIII,
v.5) that the reduction of U_3O_8 in hydrogen occurs in two steps contradicts
the modern view on the mechanism of indirect reduction of metal oxides. A
recent publication by S. Andorson and J.C. Clayton [Ref.6: J.Inorg.Nuclear
Chem.,7,4 (1958)] on reduction of U_4O_9 is of interest, but it contains only
data concerning the last stage of reduction from U_3O_8 to UO_2. The present

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Reduction of U_3O_8 by Hydrogen

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investigation was made in a high-vacuum-circulation apparatus (evacuated to 10^{-4} torr) incorporating a recording vacuum balance. The investigated "green" U_3O_8 was obtained by heating UO_3 (specific surface area 4.1 m^2/g) at 600°C. The rate of the reduction process was controlled by the weight decrease of the U_3O_8 sample (weighing approximately 0.25 g). All experiments were carried to complete ceasing of reduction in a time period between 2.5 to 375 min. Typical rate curves for the effect of temperature and reduction rate are given in Fig.1 and 2 [Abstracter's note: in Fig.1 erroneously 50 mm Hg is printed instead of 200, and in Fig.2 200 mm Hg instead of 50 mm HG] while the effect of hydrogen pressure is demonstrated in Fig.3 (in the figures A = reduction rate in % reduced per min, B = total composition of the solid product of reduction, and C = degree of reduction in %). Reduction occurs with relatively constant rate at 200 torr hydrogen pressure and below 600°C (Fig.1). At 600°C and 500°C reduction rate is constant until solid $UO_{2.55}$ is formed, and at 450°C until formation of $UO_{2.62}$. After this the rate decreases until $UO_{2.45}$ is formed, then a relatively constant rate remains until the product of the composition $UO_{2.3}$-$UO_{2.28}$ is formed. The rate curve for 650°C is in the beginning somewhat different from the last-mentioned curves. Rate curves in Fig.2 start with a characteristic increase in the

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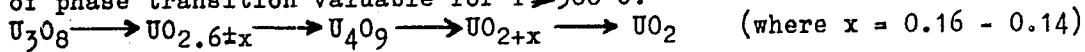Reduction of U_3O_8 by Hydrogen

reduction rate, but are otherwise similar to those at 200 torr hydrogen pres-
sure. The rate curve for the reduction at 600°C and 400 torr hydrogen pres-
sure (Fig.3) is unique starting with maximum rate and decreasing continuous-
ly until zero. The following values of apparent activation energy were cal-
culated:

hydrogen pressure in torr		200		50	
degree of reduction in %	10	40	15	40	
activation energy in kcal/mole	21.4	20.6	17.4	15.2	

In the discussion the authors point out that there is no unique opinion about
the nature of solid solutions in the uranium - oxygen system (see R. Rundle
et al.,Ref.11: J.Am.Chem.Soc., 70,99-105 (1948) and H. Hering and P. Perio,
Ref.12: Bull.Soc.Chim.France, 351-357 (1952) which consider $UO_{2.52}$ as lower
limit of the phase $UO_{2.6\pm x}$, while F. Grønvold, and H. Haraldsen, Ref.8: Na-
ture, 162,69 (1948) and H.R. Hoekstra and S. Siegel, Ref.13: Reports of
the 1st International Conference of the Peaceful Use of Atomic Energy, Geneve
(1955) suggest $UO_{2.56}$ as limit) as well as concerning the limit of solubility
of oxygen in UO_2 forming non-stoichiometric UO_{2+x} [see D. Vaughan, R. Wil-
lardson, Ref.14: Preprint Nucl. Energy a.Sci.Conf.s.a., 13,15 (1958)]. Cor-
responding to A.A. Baykov's principle of sequence of chemical reactions [Ref.
15: Metallurg, 3,5 (1956)] the present authors consider the following scheme

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Reduction of U_3O_8 by Hydrogen

of phase transition valuable for $T > 500^{\circ}C$:

$$U_3O_8 \longrightarrow UO_{2.6\pm x} \longrightarrow U_4O_9 \longrightarrow UO_{2+x} \longrightarrow UO_2 \quad (\text{where } x = 0.16 - 0.14)$$

The first step occurs under kinetic conditions and is controlled by the sur-
face reaction between adsorbed hydrogen and the oxygen of the oxide. During
reduction the crystal lattice is disordered and new active centers formed (by
chain mechanism), which increase the surface reaction rate. Simultaneously
oxygen concentration in the surface layer of the oxide decreases and inhibits
the surface reaction. The beginning of the reduction is controlled by the
formation of active centers, thus reduction rate increases with degree of re-
duction. Herewith the increase in the reduction rate (Fig.2) at the beginning
can be explained, while at hydrogen pressures of 200 torr (Fig.1) this step
is so fast that it cannot be observed experimentally. When both above-men-
tioned factors are in equilibrium the reduction process has a constant rate.
The continuous decrease in reaction rate at the end of the reduction stage of
the phase $UO_{2.6\pm x}$ (successive transition into the phase $UO_{2.6-x_{max}}$) can be
explained by the fact that the number of newly formed active centers is limit-
ed, while the concentration of oxygen in the condensed phase decrease with
the progress of the reduction process. In literature $UO_{2.6\pm x}$ is considered
to be the lower phase limit and in the present experiments the reduction rate

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Reduction of U_3O_8 by Hydrogen

stopped to decrease with the oxide $UO_{2.45}$. This difference can be explain-
ed by the fact that the reduction process did not occur in single zones.
The second horizontal part of the rate curves in Fig.1-3 corresponds to the
phase transition of $UO_{2.6-x_{max}} \rightarrow U_4O_9$. If formation of U_4O_9 is due to a
well-regulated, and formation of $UO_{2.6-x_{max}}$ to a non-regulated introduction
of oxygen into the cubic lattice of uranium oxide (see Ref.13) there should
be no great change in the crystal lattice, and oxygen evolution should occur
successively. This is the reason that in this step the reduction rate de-
creases continuously with the progress of the process. Apparently this step
occurs under diffusion conditions, controlled by the diffusion of oxygen to-
wards the place where the reaction occurs. There are 3 figures and 16 re-
ferences: 9 Soviet-bloc and 7 non-Soviet-bloc.

SUBMITTED: May 10, 1960

Card 5/8

_21.2100_

S/080/61/034/008/005/018
D204/D305

AUTHORS: Vlasov, V.G. and Lebedyev, A.G.

TITLE: The dissociation kinetics of uranium oxides

PERIODICAL: Zhurnal prikladnoy khimii, v. 34, no. 8, 1961,
              1739-1744

TEXT: The present work was undertaken because of the lack of in-
formation on the kinetics and mechanism of the dissociation pro-
cesses of uranium oxides. Knowledge of these would be of interest
for technological processes, based on the dissociation of oxides
as well as being examples of a topochemical process. Specifically,
UO_3 and U_3O_8 were investigated. UO_3 was prepared by heating $UO_4 \cdot$
nH_2O in a stream of O_2 for 3 hours at $350^{\circ}C$, followed by 1 hour at
$400^{\circ}C$; the resulting product was finely ground and pelletized. U_3O_8
was prepared by heating $UO_4 nH_2O$ in air for 1 hour at $800^{\circ}C$ and then
in O_2 for 1 hour at $900^{\circ}C$: this product was pulverized and used in
a powdery form. Dissociation processes were followed by continuous-
ly recording the loss of weight of the heated oxides by means of a

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The dissociation kinetics...

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D204/D305

spring balance. The initial rate of dissociation was determined by
the angle of the tangent to the curve of oxygen removal plotted
against time. The apparent activation energy was calculated from
Arrenius' equation. Results: UO_3 dissociates at a convenient rate
at 450-650°C, while complete conversion into U_3O_8 was reached only
at 550°C and above. At 450°C, UO_3 dissociates at a constant rate,
following the equation: $g = 0.168 t$ (g - degree of dissociation, %:
t - time elapsed from the onset of the desired temp. min). At
g = 42%, the rate diminishes abruptly and then becomes constant, as
shown by equation: $g = 0.091t + 17.90$. At 500°C, the initial rate
follows equation $g = t + 9$ and after g = 30% dissociation is expres-
sed by $(g - 30)^2 = 15.3 (t - 21)$. At 550°C the expression is $g =
4.65t + 40.9$ until g = 65% and thereafter $\lg \frac{g}{100 - g} = 0.0608$.

The influence of O_2 at various part. pressures, on the rate of dis-
sociation of UO_3 was investigated and found to be represented by

equation: $v = A - kp_{O_2}$, where A and k are constants at a given

temperature. The apparent energy of activation, calculated from

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D204/D305

The dissociation kinetics...

g   30% was 37.2 Kcals/mole. U_3O_8 at 700°C dissociates at a constant rate, following the equation: $g = 0.03 t$. At 800°C the corresponding expression is $\lg \frac{a}{a - g} = k_1 t$, (a - degree of dissociation, %, corresponding to the conversion $U_3O_8 \rightarrow UO_{2.6}$ ÷x of a minimum oxygen content, i.e. $UO_{2.55}$); a is 17.9% and values of k_1 at 800, 900 and 1000°C are $3.08 \cdot 10^{-3}$, and $1.97 \cdot 10^{-2}$ respectively. Beyond a ± 18% dissociation proceeds at a constant rate and is represented by: $g = k_2(t - t_0) - 18$, where t_0 is the time required for reaching g ± 18% and k_2 - a constant at a given temperature, values of k_2 and t_0 are given below:

temp. (°C)	1000	900	800
k_2	0.1	0.06	0.04
t_0 (min)	70	165	330

There are 3 figures and 10 references: 7 Soviet-bloc and 3 non-Soviet-bloc. The references to the English-language publications read as follows: F. Gronvold, J. Inorg. Nucl. Chem. 1, 357 (1955); The

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The dissociation kinetics...

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Transuranium Elements, Part II, Papers 6, 40 to 22, 80, d61, New-York - Toronto - London (1949).

SUBMITTED: October 3, 1960

Card 4/4

39932
S/149/62/000/004/002/003
A006/A101

$\lambda | \cdot \gamma | 0^{0}$

AUTHORS: Bessonov, A. F., Vlasov, V. G.

TITLE: Kinetics of uranium oxidation with air, oxygen and carbon dioxide

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy, Tsvetnaya metallurgiya,
no. 4, 1962, 137 - 142

TEXT: Oxidation of uranium metal was studied in aggressive gas media at
various temperatures and pressures of the oxidizing gas, for the purpose of ob-
taining kinetic characteristics and revealing the mechanism of the process. Com-
mercially pure uranium metal plates (2.5x1.5x1.5 mm) were oxidized in a high-vac-
uum device. The true rate of the oxidation process was graphically determined from
the inclination angle of the tangent to the "oxidation degree-versus-time" curve.
The apparent activation energy was calculated with the aid of the Arrhenius equa-
tion. The average composition of the oxidation product was determined by calculat-
ing the increase in weight of the specimen during oxidation and the loss in weight
during reduction with hydrogen. It was found that the oxidation process in all the
given aggressive media obeys the temporary linear law; the rate of the process is
proportional to the square root from air and oxygen pressure. The possible mechan-
ism of the uranium oxidation is analyzed with the aid of Soviet and foreign

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Kinetics of uranium oxidation with air,...

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sources (Ref. 9: P. Chiotti, H. Klepfer, R. White. Trans.Amer.Soc.Metals, 51, 772 (1959)). It was found that the diffusion of oxygen atoms through a dense layer of uranium dioxide was the decisive limiting stage. There are 4 figures.

ASSOCIATION: Ural'skiy politekhnicheskiy institut (Ural Polytechnic Institute)

SUBMITTED: July 25, 1960

Card 2/2

S/149/62/000/005/004/008
A006/A101

AUTHORS: Vlasov, V. G., Bessonov, A. F.

TITLE: Oxidation of uranium dioxide

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy, Tsvetnaya metallurgiya,
              no. 5, 1962, 113 - 122

TEXT: Since the opinions of scientists differ on the mechanism of the
oxidation process of uranium dioxide, the gathering of experimental data in this
field is imperative. The authors studied kinetics of uranium dioxide oxidation
in different gas media and investigated simultaneously the effect of the admix-
ture of alkali metal carbonates and ThO_3, ZrO_2 and TiO_2 oxides upon the kinetic
characteristics of the oxidation process. Kinetics of oxidation with air oxygen
was studied within a range of 165 to 800°C, at 2.5 - 600 mm Hg atmospheric pres-
sure. The results are shown in Graph (2). Determined values of the apparent ac-
tivation energy at different oxidation degrees range from 34.6 kcal/mole at 28%
oxidation to 39.4 kcal/mole at 90% oxidation. Kinetic characteristics of UO_2
oxidation with pure oxygen were investigated in a range of 125 to 330°C and

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Oxidation of uranium dioxide

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P_{O_2} = 100 mm Hg. The following schemes of phase transformations are proposed: $UO_{2.04} \to UO_{2+x_{max}} \to UO_{2.25} - UO_{2.36 \pm 0.05} \to UO_{2.6-x_{max}} \to UO_{2.67}$ for the 260 to 390°C range, and $UO_{2.04} \to UO_{2+x_{max}} \to UO_{2.25} \to UO_{2.6-x_{max}} \to UO_{2.67}$ for the 400 to 800°C range. The effect of different admixtures upon the process is given in Figures 5 and 6. Due to the liberation of considerable amounts of heat in oxidation of UO_2 to U_3O_8, local overheating occurs in the solid phases, entailing a sharp increase in the process rate on these spots, so that several phase transitions take place. This explains the jumplike evolution of the process in the 150 - 200°C range. The inhibiting effect of K_2CO_3 admixtures on UO_2 oxidation at 185°C is apparently due to the fact that at this temperature the migration of potassium ions from the carbonate crystal lattice into that of UO_2 is little probable. Simultaneously the admixture is in a close contact with UO_2 and screens a portion of its surface. As a result, the surface for oxygen adsorption from the gaseous phase is reduced and the total rate of the oxidation process decreases. At 330°C the accelerating effect of alkali metal carbonates appears on those stages where a substantial reconstruction of the crystal lattice takes place. Apparently the catalytic effect of carbonates consists in the fact that

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Oxidation of uranium dioxide

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their particles are crystallization centers of a new phase which eliminates the induction period. There are 6 figures.

ASSOCIATION: Ural'skiy politekhnicheskiy institut (Ural Polytechnic Institute)
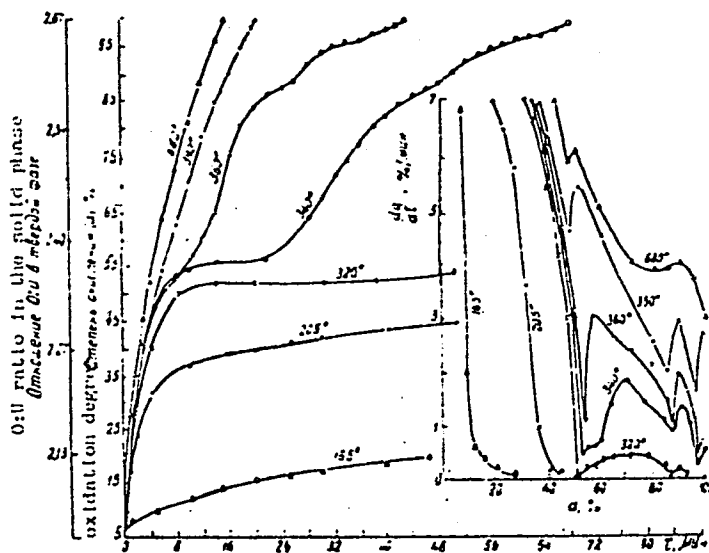
SUBMITTED: April 22, 1961

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Oxidation of uranium dioxide

S/149/62/000/005/004/008
A006/A101

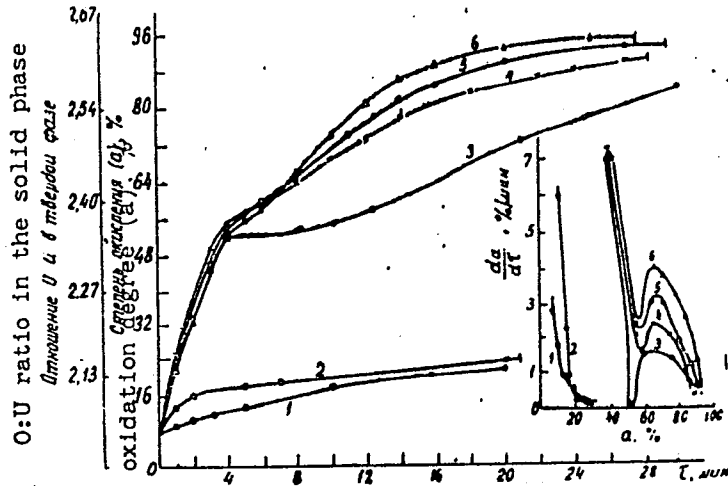Figure 2. Isotherms of UO_2 oxidation with air oxygen (at constant 200 mm Hg air pressure)

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Oxidation of uranium dioxide

Figure 5.   Isotherms of UO₂ oxidation with air oxygen at 185°C (1 and 2) and at
330°C (3 - 6) without admixtures (2 and 3) and with admixtures of
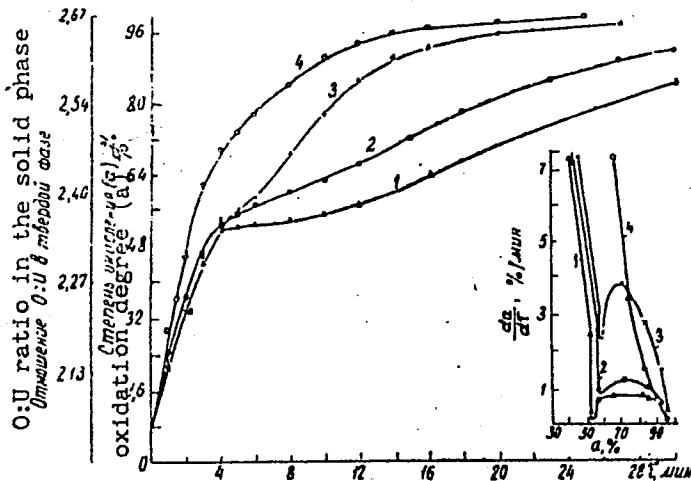K₂CO₃ (1 and 4), Na₂CO₃ (5); Li₂CO₃ (6).

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Oxidation of uranium dioxide

Figure 6. Isotherms of UO$_2$ oxidation with air oxygen at 330°C without admixture (1) and with admixture of ThO$_2$ (2); ZrO$_2$ (3) and TiO$_2$ (4)

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