

SHEVCHENKO, V. B., POVITSKIY, N. S. and SOLOVĖIN, A. S.

"Some Features of Processing Irradiated Fuel Elements at the First Atomic  
EP Power Station in the U.S.S.R."

paper to be presented at 2nd UN Intl. Conf. on the peaceful uses of Atomic  
Energy, Geneva, 1 - 13 Sep 58.

SHEVCHENKO, V. B.

78-1-41/43

AUTHORS: Shevchenko, V. B. , Shilin, I. V. , Solovkin, A. S.

TITLE: Extraction of Perchloric Acid and Uranyl Perchlorate With Tributyl Phosphate (Ekstraktsiya khlornoy kisloty i perkhlorata uranila tributilfosfatom)

PERIODICAL: Zhurnal Neorganicheskoy Khimii, 1958, Vol. 3, Nr 1, pp.225-230 (USSR)

ABSTRACT: It is generally maintained in literature that the perchlorate-ion has no inclination to form complexes with the elements of the actinide series (reference 1). Perchloric acid and its soluble salts are therefore often used for the maintenance of the ionic density when the investigation of the nature of the compounds existing in aqueous solutions is required (e.g. extraction in tributyl phosphate). The transition of  $HClO_4$  into the organic phase is usually neglected. The authors proved however (reference 4) that the value of the equilibrium-constant of the reaction of  $HClO_4$  with TBPh ( $K_1$ ) can be compared with that of  $HNO_3$  with TBPh.<sup>4</sup> The investigation of

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Extraction of Perchloric Acid and Uranyl Perchlorate With Tributyl Phosphate

$K_{\text{PuO}_2(\text{ClO}_4)}$ . The test results are given in tables 1 to 3. They show above all that U(VL) is extracted to a considerable extent from perchloric acid solutions by TBPh though the values of the coefficients of distribution here, with equal other test conditions were much smaller than with an extraction from nitric acid solutions. Nevertheless uranium passes completely over into the organic phase (table 2) at high TBPh-concentrations in the organic phase, or when a salting out-salt is present in the aqueous phase (e.g.  $\text{NaClO}_4$ ) after a single shaking. It became evident by further tests that the graphical method of the determination of the composition of the complex compound extracted by TBPh cannot be applied in the case of perchloric acid solutions. Hence, it does not follow that the mechanism of extraction of  $\text{HClO}_4$  and of  $\text{UO}_2(\text{ClO}_4)_2$  differs substantially from that of the nitric acid solutions by TBPh. It can apparently be expected that  $\text{HClO}_4$  and uranyl perchlorate pass over into the organic phase which contains TBPh, as solvents  $\text{HClO}_4 \cdot \gamma\text{TBPh}$  and  $\text{UO}_2(\text{ClO}_4)_2 \cdot x\text{TBPh}$ . There are 1 figure, 3 tables, and 12 references;

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Extraction of Perchloric Acid and Uranyl Perchlorate With Tributyl Phosphate

8 of which are Slavic.

SUBMITTED: May 22, 1957

AVAILABLE: Library of Congress

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SOV/78-3-8-36/48

The Extraction of Protactinium by Means of Alkyl Phosphoric Acids

ASSOCIATION: Khimiko-tekhnologicheskii institut im. D. I. Mendeleeva  
(Chemical-Technological Institute imeni D. I. Mendeleev)

SUBMITTED: December 3, 1957

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SOV/78-3-8-37/48

AUTHORS:

Mikhaylov, V. A., Shevchenko, V. B.,  
Kolganov, V. A.

TITLE:

Investigation of the Extraction of Protactinium by Mono- and  
Diisoamyl Phosphoric Acids (Issledovaniye ekstraktsii  
protaktiniya mono- i diizoamilfosfornoy kislotami)

PERIODICAL:

Zhurnal neorganicheskoy khimii, 1958, Vol. 3, Nr 8, pp. 1959-  
1964 (USSR)

ABSTRACT:

In the present paper the results of detailed investigations on  
the extraction of protactinium by mono- and diisoamyl phos-  
phoric acid from nitric acid solutions are given. The dependence  
of the extraction of protactinium by mono- and diisoamyl phos-  
phoric acid on the concentration of the extractive and the con-  
centration of  $H^+$  and  $NO_3^-$  in the aqueous phase were investigated.

It is shown that in the extraction with dialkyl phosphoric acid  
the distribution coefficient of protactinium is proportional to  
the square of the concentration of the extractive in the organic  
phase. The concentration of nitric acid ions is of no importance  
in the extraction of protactinium. From the experimental re-  
sults may be concluded that in the extraction of protactinium

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Investigation of the Extraction of Protactinium by Mono- and Diisoamyl Phosphoric Acids

with isoamyl phosphoric acid the extractive is at the same time a complex former in aqueous phase. The probable mechanism of the extraction of protactinium with isoamyl phosphoric acid under the formation of highly hydrolyzable complex compounds between protactinium and extractive in the aqueous phase, and the transition from protactinium in organic phase in form of  $\text{PaK}_5$  were suggested (isoamyl phosphoric acid is called HK)  
There are 3 figures, 4 tables, and 9 references, 3 of which are Soviet.

ASSOCIATION: Khimiko-tekhnologicheskii institut im. D. I. Mendeleeva  
(Chemical and Technological Institute imeni D. I. Mendeleev)

SUBMITTED: December 9, 1957

Card 2/2

SOV/78-3-8-38/48

AUTHORS: Shevchenko. V. B., Solovkin, A. S., Shilin, I. V.

TITLE: About the Extraction of the Uranyl Perchlorate by Means of Tributyl Phosphate (K ekstraktsii perkhlorata uranila tri-butilfosfatom)

PERIODICAL: Zhurnal neorganicheskoy khimii, 1958, Vol. 3, Nr. 8, pp. 1965-1967 (USSR)

ABSTRACT: The distribution of uranyl perchlorate between water and a solution of 1,2 mol. of tributyl phosphate (TBP) in  $\text{CCl}_4$  was studied as a function of the concentration of the salt in aqueous solution (Table 1). It was shown that  $\text{K}_{\text{PuO}_2(\text{ClO}_4)_2}$  increases with a rise of the uranyl concentration in the solution. When uranyl perchlorate is extracted by means of tributyl phosphate an increase of the water contents occurs in the organic phase. In virtue of the experiments it is assumed that uranyl perchlorate is extracted by tributyl phosphate in the form of the following compound:  $\text{UO}_2(\text{ClO}_4)_2 \cdot 2\text{H}_2\text{O} \cdot 2\text{TBP}$ .

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There are 1 figure, 1 table, and 4 references, 2 of which are



About the Extraction of the Uranyl Perchlorate by Means of Tributyl Phosphate

SOV/78-3-8-38/48

Soviet.

SUBMITTED: February 28, 1958

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SOV/78-3-9-16/38

AUTHORS:

~~Shevchenko, V. B., Foyitskiy, N. S., Solovkin, A. S., Shilin, I. V., Lunichkina, K. P., Tsvetkova, Z. N.~~

TITLE:

The Extraction of Nitric Acid With Tributyl Phosphate  
(Ekstraktsiya azotnoy kisloty v tributilfosfat)

PERIODICAL:

Zhurnal neorganicheskoy khimii, 1958, Vol 3, Nr 9, pp 2109-2112  
(USSR)

ABSTRACT:

The distribution of nitric acid between the aqueous and the organic phase containing tributyl phosphate in dependence on the aqueous phase and the nature of the solvent of tributyl phosphate was investigated. From the results may be concluded that  $K_p$  considerably depends on the nature of the solvents of tributyl phosphate. The influence of the nature of the solvents on the distribution of nitric acid between water and tributyl phosphate was investigated in the case of an ionic strength of the solution of 1, 0,5 and 3. The maximum value of  $K_p$  in nitric acid solution with the ionic strength of 3 is obtained if toluene is used as solvent for tributyl phosphate. The change of  $K_p$  by the nature of the solvent in the case of an

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The Extraction of Nitric Acid With Tributyl Phosphate

ionic strength of 3 is to be divided as follows: toluene, benzene, kerosene,  $\text{CCl}_2\text{F}-\text{CCl}_2\text{F}$ ,  $\text{CCl}_4$ . The following variation of the above sequence takes place if the ionic strength is reduced to 1: kerosene, toluene, benzene,  $\text{CCl}_2\text{F}-\text{CCl}_2\text{F}$ ,  $\text{CCl}_4$ .

Comparative investigations of the extractions in  $\text{HClO}_4$  and  $\text{HNO}_3$  solutions showed that the complex  $\text{HClO}_4 \cdot \text{TBPh}$  is to a greater extent polar than the complex  $\text{HNO}_3 \cdot \text{TBPh}$ .

There are 2 figures, 1 table, and 9 references, 4 of which are Soviet.

SUBMITTED:

August 3, 1957

Card 2/2

SEVCENKO, V.B. [Shevchenko, V.B.]; POVICKIJ, N.S. [Povitskiy, N.S.];  
SOLOVKIN, A.S.; KORTUS, J. [translator]

Some peculiarities in processing the burnt out fuel elements  
from the first atomic power plant in the Soviet Union. Jaderna  
energie 4 no.11:342-344 N '58.

SOV/89-5-5-5/27

5(2)  
AUTHORS:

Shevchenko, V. B., Smelov, V. S.

TITLE:

The Influence of Mono- and Dibutyl Phosphates on the Separation of Plutonium by Tributyl Phosphate (Vliyaniye mono- i dibutilfosfatov na ekstraktsiyu plutoniya tributilfosfatom)

PERIODICAL:

Atomnaya energiya, 1958, Vol 5, Nr 5, PP 542-545 (USSR)

ABSTRACT:

The distribution coefficients for mono- and dibutyl phosphate (MBPh and DBPh) between the organic phase, which contained tributyl phosphate in hydrated petroleum, and water were determined. The same coefficients were also determined between the organic phase and a solution of nitric acid, a lye, and a soda solution. The experimentally determined coefficients are shown in form of a table and a graph. The determination of the distribution of plutonium was carried out in glass cups. The time required for establishing equilibrium was experimentally determined as amounting to 30 minutes, and settling time was found to be 24 hours. The plutonium was found to be quadrivalent. Concentration: 50 mg/l. The plutonium was detected with the aid of its  $\alpha$ -radiation,

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PHASE I BOOK EXPLOITATION

SOV/5084

International Conference on the Peaceful Uses of Atomic Energy. 2d, Geneva, 1958.

Doklady sovetskikh uchenykh. [t.4] Khimiya radioelementov i radiatsionnykh prevrashcheniy (Reports of Soviet Scientists. v. 4.: Chemistry of Radioelements and Radiation Transformations) Moscow, Atomizdat, 1959. 323 p. 8,000 copies printed. (Series: Its: Trudy)

Ed. (Title page): A. P. Vinogradov, Academician; Ed.: V. I. Labaznov; Tech. Ed.: Ye. I. Mazel'.

PURPOSE: This collection of articles is intended for scientists and engineers interested in the applications of radioactive materials in science and industry.

COVERAGE: The book contains 26 separate studies concerning various aspects of the chemistry of certain radioactive elements and the processes of radiation effect on matter. These reports discuss present-day methods of reprocessing irradiated nuclear fuel, research in the chemistry of mercury, thorium, uranium, plutonium, and americium, problems related to the sorption and bury-

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SOV/5084

## Reports of Soviet (Cont.)

ing of radioactive wastes, the radiolysis of aqueous solutions and of organic compounds, the mechanism of polymer chain grafting, and the effect of radiation on natural and synthetic rubbers. V. N. Prusakov edited the present volume. Most of the reports are accompanied by references. Contributors to individual investigations are mentioned in annotations to the Table of Contents.

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ШЕВЧЕНКО, В.В.

21(4) **PHASE I BOOK EXPLOITATION** 80V/2713

International Conference on the Peaceful Uses of Atomic Energy. 2nd, Geneva, 1958

Додатки советских ученых; Ядерные материалы и реакторы атомной энергии для мирных целей; Nuclear Fuel and Reactor Metals Moscow, Almaty, 1959. 670 p. (Series: ITI: Trudy, vol. 3, 6,000 copies printed.

Ed. (Title page): A.A. Kochur, Academician, A.P. Vinogradov, Academician, V.B. Yemel'nikov, Corresponding Member, Academy of Sciences, and A.P. Zafirov, Doctor of Technical Sciences. Ed. (Title Book): V.V. Pavlovskiy and G.M. Pchelintseva; Tech. Ed.: N.I. Masal'.

**PURPOSE:** This volume is intended for scientists, engineers, physicists, and biologists working in the production and peaceful application of atomic energy; for professors and students of schools of higher technical education where the subject is taught; and for people interested in atomic science and technology.

**CONTENTS:** This is volume 3 of a 6-volume set of reports on atomic energy, presented by Soviet scientists at the Second International Conference on the Peaceful Uses of Atomic Energy, held in Geneva from September 1 to 13, 1958. Volume 3 consists of two parts. The first part, edited by A.I. Zubov, is devoted to general problems of atomic energy, including processing of nuclear source materials. The second part, edited by G.I. Zolotarev, is devoted to reactor metals, and neutron irradiation effects on metals. The titles of the individual papers in most cases correspond word for word with those in the official English language edition on the Conference proceedings. See 80V/2081 for the titles of the other volumes of the set.

**Editorial Board:** V.B. Yemel'nikov, M.I. Solov'ev, A.M. Shishov, and V.M. Lazarenko. **Publication of Proceedings from Synthetic Materials and Ores** (Report No. 2062)

**Krylov, K.A., and I.V. Kargin.** Flammability of Berry. (Report No. 2065) 299

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SHEVCHENKO, V.B.; SOLOVKIN, A.S.; SHILIN, I.V.; KIRILLOV, L.M.; RODIONOV,  
A.V.; BALANDINA, V.V.

Effect of the nature of the diluent on the extraction of uranyl  
nitrate by tributylphosphate. Radiokhimiia 1 no.3:257-269  
'59. (MIRA 12:10)  
(Uranyl nitrate) (Butyl phosphate)

21(1)

AUTHORS:

Shevchenko, V. B., Smelov, V. S.

SOV/89-6-2-5/28

TITLE:

On the Mechanism of Plutonium Nitrate Extraction by Mono- and Dibutylphosphates (K voprosu o mekhanizme ekstraktsii nitrata plutoniya mono- i dibutilfosfatami)

PERIODICAL:

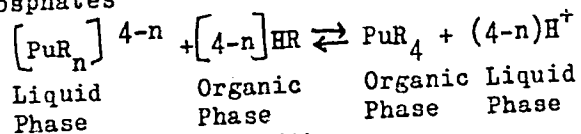
Atomnaya energiya, 1959, Vol 6, Nr 2, pp 140 - 144 (USSR)

ABSTRACT:

The mechanism of plutonium extraction by monobutylphosphate (MBP) and dibutylphosphate (DBP) is explained. Furthermore the mechanism of plutonium nitrate extraction by MBP and DBP is investigated with an ionic concentration of 6. In paper 1 the experiments are described more in detail. The following method of analysis was applied: After the solution had settled for 24 hours the plutonium content was determined by counting the  $\alpha$ -particles. Self-absorption was taken into account in solutions containing much  $\text{LiNO}_3$ . There was an error of 5-7% in the determination of the results of two simultaneously investigated samples. The analysis of MBP and DBP was carried out according to the method mentioned in reference 1. MBP and DBP were determined with an accuracy of 7-12%. The extraction process may be represented in the general form

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On the Mechanism of Plutonium Nitrate Extraction by Mono- SOV/89-6-2-5/28  
and Dibutylphosphates



where R denotes either  $[\text{H}(\text{C}_4\text{H}_9)\text{PO}_4]'$  or  $[(\text{C}_4\text{H}_9)_2\text{PO}_4]'$  and n may adopt the values 1, 2, 3 and 4. Since the equilibrium concentration of plutonium in the aqueous solution is smaller than  $2 \cdot 10^{-4}$  mol/l, the formation of atomic compounds must be neglected. The equilibrium constant of the above-mentioned reaction has the form:

$$K_P = \frac{C_{\text{PuR}_4} \cdot C_{\text{H}^+}^{4-n}}{C_{\text{PuR}_n}^{4-n} \cdot C_{\text{HR}}^{4-n}}$$

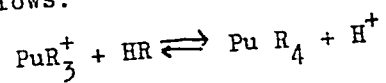
The indices denoting the phases are not mentioned here. The plutonium distribution coefficient E may be determined according to the equation:

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On the Mechanism of Plutonium Nitrate Extraction by Mono- SOV/89-6-2-5/28  
and Dibutylphosphates

$$E = \frac{C_{\text{PuR}_4}}{C_{\text{PuR}_n}^{4-n}}$$

Since the effect of  $\text{NO}_3^-$  ions on the plutonium distribution coefficient is insignificant, the possibility of complex formation was not taken into account. The presence of complex compounds with the ions  $\text{R}'$  and  $[\text{NO}_3]'$  and the ions  $\text{R}'$  and  $[\text{OH}]'$  was not taken into account either. It was demonstrated in an earlier paper that the dependence of the plutonium distribution coefficient on the MBP, DBP and  $\text{H}^+$  concentration may be represented by a straight line with  $\text{tg}\alpha = 1$ . According to these results the formula introductorily mentioned may be expressed as follows:



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On the Mechanism of Plutonium Nitrate Extraction by  
Mono- and Dibutylphosphates

SOV/89-6-2-5/28

Thus it is demonstrated that the complex formation in the liquid phase is also due to the extracting agent. The equilibrium constant of the interaction of plutonium nitrate with MBP is  $(1.5 \pm 0.25) \cdot 10^3$ , and  $(6.15 \pm 0.85) \cdot 10^3$  with DBP. There are 5 figures, 4 tables, and 3 references, 2 of which are Soviet.

SUBMITTED: May 7, 1958

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21(1), 5(2)

SOV/89-6-4-5/27

AUTHORS: Shevchenko, V. B., Timoshev, V. G., Volkova, A. A.

TITLE: The Stability Constants of the Nitrate Complexes of Trivalent Plutonium and Tributyl Phosphate Solutions (Konstanty ustoychivosti nitratnykh kompleksov trekhvalentnogo plutoniya v vodnykh i tributilfosfatnykh rastvorakh)

PERIODICAL: Atomnaya energiya, 1959, Vol 6, Nr 4, pp 426-430 (USSR)

ABSTRACT: The distribution of nitric acid and plutonium nitrate between the aqueous phase and tributyl phosphate (TBF) dissolved in benzene is measured. Extraction was carried out in calibrated test tubes. Mixing of phases was carried out mechanically. The initial quantities for the aqueous and organic solutions were 5 ml. All chemicals were especially purified before the experiments. Thus, the water content of TBF was only 0.11%. The reduction of the Pu from the aqueous plutonium nitrate solution ( $\sim 5 \cdot 10^{-4}$  M) and from hydrazine nitrate (0.2 M) was carried out at 50-60° in the course of 3-4 hours. Plutonium valence was measured and calculated respectively both spectrophotometrically as also from the constancy of the plutonium distribution coefficient at the various reduction steps (from one

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SOV/89-6-4-5/27

## The Stability Constants of the Nitrate Complexes of Trivalent Plutonium and Tributyl Phosphate Solutions

and the same aqueous solution). The plutonium content in the aqueous and organic phases was determined radiometrically. Hydrazine concentration was measured by titration of the hydrazine solution with potassium permanganate in a hydrochloric acid medium in the presence of ammonium vanadate. It could be shown that trivalent plutonium is extracted from a solution combined with nitric acid by TBF in form of  $\text{Pu}(\text{NO}_3)_3 \cdot \text{TBF}$  (nitration concentration up to 1.2 M). In the case of the aforementioned experimental conditions, the distribution coefficient of trivalent plutonium does not depend on hydrogen ion concentration. The measured values are given in tables and partly in form of graphs. Good agreement was found between calculated and measured distribution coefficients. The stability constants for various plutonium complexes were determined as follows:

$\text{Pu}(\text{NO}_3)_3 \cdot 3\text{TBF}$	$0.75 \pm 0.10$ ,	$\text{Pu}(\text{NO}_3)_3$	$14.4 \pm 0.8$
$\text{Pu}(\text{NO}_3)_2^+$	$14.3 \pm 0.8$ ,	$\text{Pu}(\text{NO}_3)_3^{2+}$	$5.9 \pm 0.5$

There are 3 figures, 5 tables, and 14 references, 10 of which are Soviet.

SUBMITTED:  
Card 2/2

May 16, 1958



SOV/89-7-3-6/29

5(3)  
AUTHORS:

Shevchenko, V. B., Slepchenko, I. G., Shmidt, V. S.,  
Nenarokomov, E. A.

TITLE:

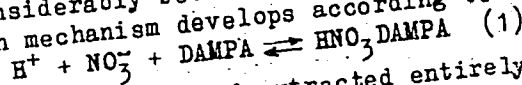
Extraction Properties of Di-isoamyl Ester of Methyl Phosphoric  
Acid

PERIODICAL:

Atomnaya energiya, 1959, Vol 7, Nr 3, pp 236-243 (USSR)

ABSTRACT:

By hitherto known methods the distribution coefficients of  $HNO_3$  and uranyl nitrate in solutions of nitric acid and solutions of  ${}^3DAMPA$  (di-isoamyl ester of methyl-phosphoric acid) in petroleum were determined on the basis of the  $DAMPA$ -content in the extractive and on the  $UO_2(NO_3)_2$  and  $HNO_3$ -content in the aqueous phase. It could be shown that, especially in the aqueous phase, small uranium concentrations can be extracted with  $DAMPA$  considerably better than with TBP (tributyl phosphate). The extraction mechanism develops according to the equation



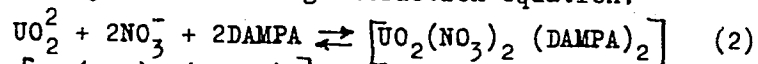
where  $HNO_3 \cdot DAMPA$  is a compound extracted entirely from the organic phase. The rules governing the extraction of uranium from solutions containing nitric acid by  $DAMPA$ -solutions may be

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Extraction Properties of Di-isoamyl Ester of Methyl Phosphoric Acid

explained by the following extraction equation:



where  $[\text{UO}_2(\text{NO}_3)_2 (\text{DAMPA})_2]$  is a compound extracted entirely from the organic phase. The equilibrium constant of reaction (1) by using 10- and 20% DAMPA-solutions is  $0.30 \pm 0.03$  (measured value). The equilibrium constant of reaction (2) with a 20% DAMPA-solution, however, is  $2540 \pm 200$ . The values determined during the various experimental stages are represented partly by tables and partly graphically. There are 10 figures, 5 tables, and 20 references, 14 of which are Soviet.

SUBMITTED: December 11, 1958

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S/186/60/002/001/002/022

A057/A129

213200

AUTHORS: Shevchenko, V.B.; Fedorov, I.A.

TITLE: Effect of the temperature on the extraction of uranyl-, plutonium-, ruthenium-, and zirconium-nitrates with tributyl phosphate

PERIODICAL: Radiokhimiya, v. 2, no. 1, 1960, 6 - 12

TEXT: In the present paper an attempt was made to determine basic conditions concerning the temperature effect on tributylphosphate (TBP) extraction of uranyl-, plutonium-, ruthenium-, or zirconium-nitrate. Literature data regarding this problem are incomplete or not systematic. Nevertheless the knowledge of the temperature effect on extraction is important for the separation of uranium and plutonium from fission products. The present experiments were carried out with initial solutions of uranyl nitrate in concentrations of 0.01, 0.2 and 0.8 M, while solutions with other elements contained just tracer amounts of these. The tributylphosphate concentration varied from 0.3 to 3.67 M, using as diluent a mixture of saturates hydrocarbons (boiling at 182 - 222°C). During the extraction the temperature was kept with an accuracy of  $\pm 0.1^\circ\text{C}$  at 5, 10, 20, 30, 40, 60, or 80°C. Initial volumes of 10 - 20 ml were used, equilibrium was reached in

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Effect of the temperature on the extraction of....

S/186/60/002/001/002/022

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5 - 10 min, and the samples were allowed to stand for 30 - 40 min (with 3.67 M TBP for several hours). The acidity of the initial solutions was determined by potentiometry, uranium was determined by gravimetry (or colorimetry with Na-diethyl dithiocarbamate), while Zr, Ru, and Pu were determined by radiometry. The distribution coefficient  $K_p$  was calculated from the ratio ( $C_o/C_{aq}$ ) of the concentration in the organic and aqueous phase. Experimental data (Fig. 1) demonstrate that with increasing temperature the distribution coefficient for  $HNO_3$  between water and 1.43 M TBP decreases. By increasing  $HNO_3$  concentration a decrease in the effect of the temperature on  $K_p$  can be observed. Thus an increase from 5°C to 80°C decreases  $K_p$  twice for extractions from 0.5 N  $HNO_3$  solutions, 1.7 times for 1.72 N  $HNO_3$ , and 1.3 times for 3 N  $HNO_3$  solutions. Apparently, constancy of  $K_p$   $HNO_3$  [observed by B. Weaver et al, Ref. 5: J. Am. Chem. Soc., 75, 16, 3943 1953] with changing temperature is valid only for lower acidities (from 5 N  $HNO_3$ ). With increasing concentration of uranyl nitrate in TBP the effect of temperature on the extraction decreases. Thus  $K_p$   $UO_2(NO_3)_2$  for extraction of an initial solution containing 0.21 M uranium in 1.7  $HNO_3$  is at 5°C 2.1 times greater than at 80°C using 1.47 M TBP as extractant, while using 0.36 M TBP the value changes 1.6 times. Extractions from 0.01 M uranium solutions are even more sensitive for changes in temperature. The curves for the dependence of  $\log K_p$  on

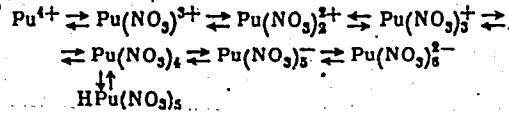
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S/186/60/002/001/002/022

A057/A129

Effect of the temperature on the extraction of....

1/T (Figs. 2, 3) demonstrate that the extraction of uranyl nitrate with TBP occurs according to the Van't Hoff equation. The reaction is isothermal and controls principally the decrease of the distribution coefficient of uranium with temperature. The temperature effect of plutonium on extraction was investigated in solutions containing and not containing uranium. The distribution coefficient of Pu<sup>4+</sup> increases with temperature from 10 to 40°C (Fig. 4) and drops then with a further temperature increase. Solutions with an initial HNO<sub>3</sub> concentration of 0.5 N (not containing uranium) show that extractability of Pu<sup>4+</sup> decreases continuously with increasing temperature (Fig. 4, curve 1). The effect of acidity on the change of the distribution coefficient with temperature interval from 10 - 40°C and is not so evident between 40 - 80°C. The present authors discuss statements of some other investigators [Ref. 8: D.W. Okendi, J. Chem. Soc., 3358 (1956); Ref. 9: G. Seaborg, J.Katz, Actinides, N.N.E.S.; Ref. 10: H.H. Anderson, The Transuranium Elements, 2, 964 (1949); Ref. 11: J.A. Brothers, R.G. Hart, W.C. Mathers, J. Inorg. Nucl. Chem., 7, 85 (1958)] concerning the state of plutonium in solutions and assume the following equilibrium in solutions with an acidity between 0.5 and 4 N HNO<sub>3</sub>:



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Effect of the temperature on the extraction of....

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With increasing acidity the amount of  $\text{Pu}(\text{NO}_3)_5^-$  increases. Supposing the whole equilibrium system is exothermic [according to Ref. 12: R.E. Connick, W.H. McVey, J. Am. Chem. Soc., 71, 3182 (1949)  $\text{Pu}^{4+} + \text{NO}_3^- \rightarrow \text{Pu}(\text{NO}_3)_3^+$  is exothermic] the present authors consider that the increasing number of nitrate groups in the plutonium nitrate complex is an exothermic process. The observed dependence of the extractability of plutonium on the temperature could thus be explained by the effect of principally two factors: 1) the shift of the equilibrium of  $\text{Pu}^{4+}$  nitrate complexes in aqueous solutions with increasing temperature, and 2) the exothermic formation of the  $\text{Pu}(\text{NO}_3)_4 \cdot 2 \text{TBP}$  complexes, which can be extracted into the organic phase. In solutions with an acidity above 1.7 N  $\text{HNO}_3$  the first factor prevails until  $40^\circ\text{C}$ , while above  $40^\circ\text{C}$  the second factor is predominant. The continuous decrease of  $K_p$  with increasing temperature in solutions with an acidity below 0.5 N  $\text{HNO}_3$  is to be explained by the summary effect of both factors. Extractability of zirconium nitrate decreases with increasing temperature (Fig. 5) between  $10$  and  $30^\circ\text{C}$ . Above  $30^\circ\text{C}$  the extractability increases with temperature. The effect of temperature is more pronounced in solutions at lower  $\text{HNO}_3$  concentration. Discussing the state of zirconium in the present investigations the authors assume, based on observations in sulfate complexes of zirconium [Ref. 16: W.B. Blumenthal, Ind. Eng. Chem., 46, 528 (1954)], that with increasing temperature the

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S/186/60/002/001/002/022  
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Effect of the temperature on the extraction of....

equilibrium between nitrate and basic zirconium salts shifts towards the formation of the latter. Thus the amount of extractable nitrate complexes decreases and accordingly also the extractability of zirconium. Increase in zirconium extractability above 30°C can be explained by the effect of some other factors, like an increase in the solubility of the zirconium solvate complex, and increasing concentration of dibutyl phosphate. Extractability of ruthenium decreases with increasing temperature (Fig. 6). The existence of the following equilibrium is assumed by D.M. Fletcher and F.S. Martin, Chemistry of Nuclear Fuels:  $[RuNO(NO_3)_3(H_2O)_2] \rightleftharpoons [RuNO(NO_3)_2OH(H_2O)_2] \rightleftharpoons [RuNO(NO_3)(OH)_2(H_2O)_2]$ . The trinitrate complex is easily extractable. With increasing temperature equilibrium shifts towards the formation of the difficultly extractable di- and mono-hydrate complexes. Thus extractability of ruthenium decreases. The maintenance of definite temperature conditions in each step of the extraction process of nuclear fuels can improve the separation of uranium and plutonium from fission products. There are 6 figures and 18 references: 1 Soviet and 17 non-Soviet.

SUBMITTED: May 20, 1959

Card 5/8 .

SHEVCHENKO, V.B.; SOLOVKIN, A.S.; SHILIN, I.V.; KIRILLOV, L.M.; RODIONOV, A.V.;  
BALANDINA, V.V.

Effect of hydrocarbons of the aliphatic and aromatic series on the extraction of U(VI), Pu(IV), Zr(IV), and Ce(III) with tri-n-butyl-phosphate from nitric acid solutions. Radiokhimiia 2 no.3:281-290 '60. (MIRA 13:10)

(Hydrocarbons) (Extraction (Chemistry))  
(Butyl phosphate)



PETROV, K.A.; SHEVCHENKO, V.B.; TIMOSHEV, V.G.; MAKLYAYEV, F.A.; FOKIN,  
A.V.; RODIONOV, A.V.; BALANDINA, V.V.; YEL'KINA, A.V.; NAGNIBIDA,  
Z.I.; VOLKOVA, A.A.

Alkyl phosphonates, diphosphonates, and phosphine oxides as  
extracting agents. Zhur.neorg.khim. 5 no.2:498-502  
F '60. (MIRA 13:6)

(Phosphonic acid) (Phosphine oxide)  
(Extraction(Chemistry))

5. 2200(A)

AUTHORS: Denotkina, R. G., Moskvin, A. I.,  
Shevchenko, V. B.

69013  
S/078/60/005/04/008/040  
B004/B007

TITLE: The Solubility Product of Bisubstituted Plutonium(IV)Phosphate and Its Solubility in Some Acids

PERIODICAL: Zhurnal neorganicheskoy khimii, 1960, Vol 5, Nr 4, pp 805 - 810 (USSR)

ABSTRACT: The authors investigated the solubility of  $\text{Pu}(\text{HPO}_4)_2 \cdot x\text{H}_2\text{O}$  in  $\text{HClO}_4$  and  $\text{HNO}_3$ , and determined the solubility product of this compound. Solubility was determined at a constant ion strength = 2, which was maintained by addition of  $\text{NaClO}_4$  or  $\text{LiNO}_3$ . The precipitation of  $\text{Pu}(\text{HPO}_4)_2 \cdot x\text{H}_2\text{O}$  (x fluctuates according to the authors' data between 1 and 4) was effected from a solution of 1 - 2 M Pu(IV)-nitrate by a solution of 0.4 M  $\text{H}_3\text{PO}_4$ . The experimental data are given as follows: Figure 1 - influence of hydrogenion concentration upon the solubility of  $\text{Pu}(\text{HPO}_4)_2 \cdot x\text{H}_2\text{O}$  in  $\text{HNO}_3$ , figure 2 - the same in  $\text{HClO}_4$ . Hydrogen ion concentration was measured by means of an LP-5 potentiometer. The solubility of

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The Solubility Product of Bisubstituted  
Plutonium(IV)Phosphate and Its Solubility in  
Some Acids

69013

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B004/B007

the solubility of the Pu(IV)phosphate was determined graphically from experimental data for the solubility of Pu(IV)phosphate in mixtures of  $\text{HNO}_3$  and  $\text{H}_3\text{PO}_4$  (Fig 3). The mean value of the solubility product determined according to the three methods is  $2.10^{-28}$ . A comparison between the solubility product of Pu(IV)phosphate and the corresponding Th- and U-compounds shows that the Pu-compound has the lowest solubility because of its lower ionic radius. There are 3 figures, 4 tables, and 6 references, 5 of which are Soviet. 4

SUBMITTED:

December 18, 1958

Card 3/3

SHEVCHENKO, V.B.; SLEPCHENKO, I.G.; SHMIDT, V.S.; MENAROKOMOV, B.A.

Mechanism of extraction of uranium (VI) with tributyl phosphate  
from hydrochloric acid solutions. Zhur.neorg.khim. 5 no.5:  
1095-1099 My '60. (MIRA 13:7)  
(Uranium) (Butyl phosphate)  
(Extraction(Chemistry))

21.3200

S/078/60/005/06/24/030  
B004/B014

AUTHORS: Shevchenko, V. B., Shilin, I. V., Zhdanov, Yu. F.

TITLE: The Behavior of Copper Nitrate in the Extraction of the Nitrates of Uranyl and Plutonium by Means of Solutions of Tributyl Phosphate

PERIODICAL: Zhurnal neorganicheskoy khimii, 1960, Vol. 5, No. 6, pp. 1366 - 1374

TEXT: The authors of the present paper wanted to study the behavior of large impurities of copper (in addition to compounds of Ni, Cr, Fe, Co, and Mo) in nuclear fuel that is regenerated by extraction by means of benzene- or kerosene solutions of tributyl phosphate (TBP). The authors write down the reaction equation (2) for the extraction of  $\text{Cu}(\text{NO}_3)_2$  and on the basis of the law of mass action they derive equation (3):  $\log K_d = \log K + x \log [\text{TBP}]_{\text{org}}$ , where  $K_d$  = distribution ratio of  $\text{Cu}(\text{NO}_3)_2$  and  $K$  = equilibrium constant. It follows from Table 1 and Fig. 1 that  $K_d$  increases with rising concentration of TBP and increasing ionic

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The Behavior of Copper Nitrate in the Extraction of the Nitrates of Uranyl and Plutonium by Means of Solutions of Tributyl Phosphate S/078/60/005/06/24/030  
B004/B014

strength  $\mu$  of the aqueous solution.  $K_d$  drops, however, with constant  $\mu$ , constant concentration of TBP, and rising concentration of the copper nitrate in the aqueous solution (Figs. 8 and 9).  $K_d$  is higher in TBP-kerosene solution than in TBP benzene (Table 2). It follows from Fig. 2 that by means of TBP benzene copper nitrate is extracted as  $\text{Cu}(\text{NO}_3)_2 \cdot 2\text{TBP} \cdot \text{H}_2\text{O}$ , whereas it is extracted as  $\text{Cu}(\text{NO}_3)_2 \cdot 3\text{TBP} \cdot 2\text{H}_2\text{O}$  by means of TBP kerosene. These compounds are only stable above  $-10^\circ\text{C}$ . Fig. 3 shows the effect of  $\text{HNO}_3$  on  $K_d$ , Fig. 4 the distribution of  $\text{HNO}_3$  among water and TBP in the presence of  $\text{Cu}(\text{NO}_3)_2$ . Fig. 5 shows that  $K_d$  does not depend on the equilibrium concentration of the  $\text{H}^+$  ion. The distribution ratio of copper nitrate is lowered by the presence of uranyl nitrate (Table 3, Fig. 6), whereas aluminum nitrate raises  $K_d$  (Fig. 7). Furthermore, the authors studied the solubility of copper nitrate in TBP as well as the physical data of this solvent (Tables 4-6, Fig. 10). TBP kerosene is divided into two layers when it is saturated

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The Behavior of Copper Nitrate in the Extraction of the Nitrates of Uranyl and Plutonium by Means of Solutions of Tributyl Phosphate S/078/60/005/06/24/030 B004/B014

with copper nitrate (Table 7). Hence, the solubility of TBP saturated with copper nitrate is limited in saturated hydrocarbons. There are 10 figures, 7 tables, and 14 references: 8 Soviet, 1 American, 3 British, 1 German, and 1 Yugoslav.

SUBMITTED: February 26, 1959

Card 3/3

*Shevchenko, V. B.*

81910  
S/078/60/005/07/05/014  
B004/B056

21,3500

AUTHORS: Denotkina, R. G., Moskvin, A. I., Shevchenko, V. B.

TITLE: Determination of the Composition and the Dissociation Constants of the Phosphate Complexes of Plutonium (IV) by Means of the Solubility Method 27

PERIODICAL: Zhurnal neorganicheskoy khimii, 1960, Vol. 5, No. 7, pp. 1509-1515

TEXT: In order to obtain stable solutions of nitric acid when dissolving the fuel elements consisting of an uranium-molybdenum alloy of the first atomic power plant of the USSR, 20-40 g/l phosphoric acid is added. This caused the authors to investigate the complex-formation of plutonium (IV) in solutions of phosphoric acid and to determine the ratio between metal and addend and the dissociation constants of the complexes. They investigated the solubility of the gelatinous  $\text{Pu}(\text{HPO}_4)_2 \cdot x\text{H}_2\text{O}$  in 0.012 to 2 mole/l phosphoric acid in the presence of 2 M  $\text{HNO}_3$  at 25°C. The experimental data are shown in Table 1 and Fig. 1. The solubility of

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Determination of the Composition and the  
Dissociation Constants of the Phosphate  
Complexes of Plutonium (IV) by Means of the Solubility Method

81910  
S/078/60/005/07/05/014  
B004/B056

plutonium (IV)-phosphate at first decreases, attains a minimum at  $1.06 \times 10^{-4}$  mole/l, after which it increases as a result of complex formation. From the curve in Fig. 1 it may be seen that the number of phosphate groups in the complex ion increases steplike from 1,2,3,4 to 5.

The following instability constants are calculated for  $[\text{Pu}(\text{HPO}_4)]^{2+}$   
 $K_{n1} = 1.2 \cdot 10^{-13}$ ; for  $[\text{Pu}(\text{HPO}_4)_2]^0$   $K_{n2} = 1.8 \cdot 10^{-24}$ ; for  $[\text{Pu}(\text{HPO}_4)_3]^{2-}$   
 $K_{n3} = 3.7 \cdot 10^{-34}$ ; for  $[\text{Pu}(\text{HPO}_4)_4]^{4-}$   $K_{n4} = 6 \cdot 10^{-44}$ ; and for  $[\text{Pu}(\text{HPO}_4)_5]^{6-}$   
 $K_{n5} = 9 \cdot 10^{-53}$ . Fig. 2 shows the dependence of the exponent of the instability constants on the ratio between metal and addend. When increasing the hydrogen-ion concentration, acidolysis of the phosphate complexes occurs, also for which the constants are calculated. Further, the solubility of the dry plutonium diphosphates in aqueous phosphoric acid solution (0.03-3.9 mole/l) was investigated. The results are given in  $\lambda$

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Determination of the Composition and the  
Dissociation Constants of the Phosphate  
Complexes of Plutonium (IV) by Means of the Solubility Method

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B004/B056

Table 2 and in Fig. 3. Complex ions with the ratio metal : addend = 1 : 3, 1 : 4, and 1 : 5 were found. Formation of these complexes could be proved by means of electromigration (Table 3). In Table 4 the instability constants of the phosphate complexes of Pu(IV) were compared with those of the complexes with other acid-anions, and the following order was found:

$\text{CO}_3^{2-} > \text{HPO}_4^{2-} > \text{C}_2\text{O}_4^{2-}$ . There are 3 figures, 4 tables, and 5 references:  
4 Soviet and 1 American. X

SUBMITTED: March 10, 1959

Card 3/3

SHEVCHENKO, V.B.; FEDOROV, I.A.; AGUREYEV, Yu.P.

[Temperature effect on the extraction of the nitrates of uranyl, plutonium, and nitric acid with tributyl phosphate] Vliianie temperatury na ekstraktsiiu tributil-fosfatom nitratov uranila, plutoniia i azotnoi kisloty. Moskva, Glav. upr. po ispol'zovaniiu atomnoi energii, 1960. 19 p. (MIRA 17:1)

(Uranyl nitrate) (Plutonium nitrates)  
(Butyl phosphates)

SHEVCHENKO, V.B.; SHMIDT, V.S.; NENAROKOMOV, E.A.; PETROV, K.A.

Extraction of nitric acid with tri-n-octylamine. Zhur. neorg.  
khim. 5 no.8:1852-1856 Ag '60. (MIRA 13:9)  
(Nitric acid) (Octylamine)

SHEVCHENKO, V.B.; SHMIDT, V.S.; MEZHOV, E.A.

Extraction of plutonium with tri-n-octylamine from hydrochloric acid solutions. Zhur. neorg. khim. 5 no.8:1911-1913 Ag '60.

(MIRA 13:9)

(Plutonium) (Octylamine)

SHEVCHENKO, V.B.; RENARD, E.V.; SOLOVKIN, A.S.

Extraction of trihydroxyglutaric acid into tri-n-butyl phosphate.  
Zhur. neorg. khim. 5 no.10:2350-2353 0 '60. (MIRA 13:10)  
(Glutaric acid) (Butyl phosphate)

84219

S/078/60/005/010/019/021

B004/B067

21.3200

AUTHORS: Shevchenko, V. B., Shmidt, V. S., Nenarokomov, E. A.TITLE: Extraction of Uranium(VI) by Means of Tri-n-octylamine  
From Nitric SolutionsPERIODICAL: Zhurnal neorganicheskoy khimii, 1960, Vol. 5, No. 10,  
pp. 2354-2362

TEXT: The authors wanted to make a detailed study of the extraction of U(VI) by means of solutions of tri-n-octylamine (TOA) in o-xylene and carbon tetrachloride. In an earlier paper (Ref. 10), it had been found that in the presence of free nitric acid the entire TOA is contained in the organic phase as  $\text{TOA} \cdot \text{HNO}_3$ . Therefore, the authors write down the following equation for the extraction of uranium:

$\text{TOA} \cdot \text{HNO}_3 \text{ org} + \text{UO}_2^{2+} \text{ aqu} + 2\text{NO}_3^- \text{ aqu} \rightleftharpoons (\text{TOA} \cdot \text{H})\text{UO}_2(\text{NO}_3)_3 \text{ org} \quad (1)$ . The dependence of the distribution coefficients on the concentration of free  $\text{TOA} \cdot \text{HNO}_3$  in the organic phase was studied at concentrations of 4.3 and

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Extraction of Uranium(VI) by Means of  
Tri-n-octylamine From Nitric Solutions

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B004/B067

5.4 mole/l  $\text{HNO}_3$  in the aqueous phase. In this connection the fact that, according to Ref. 10, the concentration of  $\text{TOA.HNO}_3$ , varies in the organic phase as a result of the reaction

$\text{H}^+_{\text{aqu}} + \text{NO}_3^-_{\text{aqu}} + \text{TOA.HNO}_3_{\text{org}} \rightleftharpoons [\text{TOA.HNO}_3]_{\text{org}} \cdot \text{HNO}_3$  (5), was taken into account. By using o-xylene as solvent the constant  $K_3$  of this reaction was found to be 0.13. Table 1 gives the values for the distribution coefficient  $\alpha$ . Fig. 1 shows that with  $K_3 = 0.13$  the distribution coefficient  $\alpha$  increases linearly with the concentration of  $\text{TOA.HNO}_3$ . At 4.3 mole/l  $\text{HNO}_3_{\text{aqu}}$  and 0.470 mole/l  $\text{TOA.HNO}_3$ ,  $\alpha$  is 1.81, at 5.4 mole/l  $\text{HNO}_3$  it is 2.50. Fig. 2 shows  $\alpha$  as a function of acidity of the aqueous phase.  $\alpha$  passes a maximum at 6 - 7 mole/l  $\text{HNO}_3$ . The decrease of  $\alpha$  with higher acid concentrations is explained by the formation of  $(\text{TOA.HNO}_3)_{\text{org}} \cdot \text{HNO}_3$  and by the occurrence of  $\text{UO}_2(\text{NO}_3)_3$  ions. In Fig. 3  $\alpha$  is represented as a function of  $[\text{H}^+]_{\text{aqu}}$ , in Fig. 4 as a function of the uranium concentration. o-xylene and carbon tetrachloride served as solvents. With very low uranium concentration in the aqueous phase  $\alpha$  is almost independent

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Extraction of Uranium(VI) by Means of  
Tri-n-octylamine From Nitric Solutions

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B004/B067

of the concentration. It is concluded therefrom that no polymerization occurs. With high uranium concentrations  $\alpha$  decreases. This is explained by the reduction of concentration of free TOA.HNO<sub>3</sub> as a result of the extraction process. In Fig. 5 the equilibrium distribution of uranium between aqueous and organic phase is shown at 0.47 mole/l TOA.HNO<sub>3</sub>, dissolved in o-C<sub>6</sub>H<sub>4</sub>(CH<sub>3</sub>)<sub>2</sub> or CCl<sub>4</sub>. Table 2 gives the dependence of  $\alpha$  on the concentration of uranium in the aqueous phase and the values for the stability constant K<sub>1</sub> of the complex  $(TOA.H)UO_2(NO_3)_3$ . These values were sufficiently constant only at uranium concentrations in the organic phase up to 0.10 mole/l. They amounted to 2.02±0.12 for 0.47 mole/l TOA.HNO<sub>3</sub> in CCl<sub>4</sub> and 2.88±0.11 in o-C<sub>6</sub>H<sub>4</sub>(CH<sub>3</sub>)<sub>2</sub>. The absorption spectrum recorded by a CΦ -2M (SF-2M) recording spectrophotometer of the organic uranium solutions in TOA is shown in Fig. 6. It considerably differs from the spectrum of uranyl nitrate, it is similar, however, to the absorption spectra of the trinitrate uranyl compounds. The optical density of UO<sub>2</sub>(NO<sub>3</sub>)<sub>2</sub> solutions in methylisobutylketone was measured at different

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Extraction of Uranium(VI) by Means of  
Tri-n-octylamine From Nitric Solutions

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B004/B067

concentrations of  $\text{TOA.HNO}_3$  (Fig. 7). The optical density attained a maximum at a ratio  $\text{UO}_2(\text{NO}_3)_2 : \text{TOA.HNO}_3 = 1 : 1$  which was also confirmed by the composition  $(\text{TOA.H})\text{UO}_2(\text{NO}_3)_3$ . The authors mention a paper by V. M. Vdovenko, A. A. Lipovskiy, and M. G. Kuzina (Ref. 11). They thank L. V. Lipis for having carried out the spectrophotometric studies. There are 7 figures, 2 tables, and 19 references: 6 Soviet, 6 US, 1 British, 2 French, and 1 German. X

SUBMITTED: July 6, 1959

Card 4/4

85627

S/078/60/005/012/014/016  
B017/B064

213100  
AUTHORS:

Shevchenko, V. B., Shilin, I. V., Zhdanov, Yu. F.

TITLE:

Behavior of Hexavalent and Trivalent Chromium<sup>1</sup> in the Extrac-  
tion of Uranyl Nitrate and Plutonium Nitrate With Tributyl  
Phosphate Solutions ✓ ✓

PERIODICAL:

Zhurnal neorganicheskoy khimii, 1960, Vol. 5, No. 12,  
pp. 2832-2840

TEXT: Published data (Refs. 2-4), show that in the uranyl nitrate ex-  
traction with some organic solvents considerable amounts of chromium are  
coextracted. The behavior of hexavalent and trivalent chromium in the ex-  
traction of uranyl nitrate and plutonium nitrate with tributyl phosphate  
solutions was studied. The dependence of the distribution coefficient  
of hexavalent chromium on the tributyl phosphate concentrations was in-  
vestigated. Hexavalent chromium was found to be extracted with tributyl  
phosphate, and the distribution coefficient of  $Cr^{6+}$  was found to increase  
when the tributyl phosphate concentration is increased. The effect of con-  
centration of hexavalent chromium upon the distribution coefficient of

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85627

Behavior of Hexavalent and Trivalent Chromium S/078/60/005/012/014/016  
in the Extraction of Uranyl Nitrate and B017/B064  
Plutonium Nitrate With Tributyl Phosphate  
Solutions

$\text{Cr}^{6+}$ , and the effect of hydrogen ion concentration upon the distribution coefficient were also studied. Data of Table 3 show that the distribution coefficient rises with increasing concentration of hydrogen ions in the aqueous phase. This proves the fact that the extraction of hexavalent chromium occurs in the form of chromic acid. The following extraction equation is given:  $\text{H}_2\text{CrO}_4 + 3 \text{TBP} \rightleftharpoons \text{H}_2\text{CrO}_4 \cdot 3 \text{TBP}$ . Fig. 4 shows the distribution coefficient of hexavalent chromium as a function of the equilibrium concentration of nitric acid in the aqueous phase. From the course of the curve it may be seen that with increased nitric acid concentration the number of associated chromic acid molecules is also increased. The effect of uranyl nitrate upon the distribution coefficient of hexavalent chromium was investigated. At a concentration of uranyl nitrate higher than 1 mole/l, the distribution coefficient of  $\text{Cr}^{6+}$  decreases. The effect of the sodium nitrate concentration upon the  $\text{Cr}^{6+}$  distribution coefficient was also studied. The dissociation constants  $K_3$  and  $K_4$  of the chromic acid - tributyl phosphate complex were determined, and the following values

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Behavior of Hexavalent and Trivalent Chromium S/078/60/005/012/014/016  
 in the Extraction of Uranyl Nitrate and B017/B064  
 Plutonium Nitrate With Tributyl Phosphate  
 Solutions

found::

$$K_3 = \frac{[H^+]_{\text{water}} \cdot [HCrO_4^-]_{\text{water}}}{[H_2CrO_4]_{\text{water}}} = 1.26$$

$$K_4 = \frac{[H_2CrO_4 \cdot 3T]_{\text{org}}}{[H_2CrO_4]_{\text{water}} \cdot T_{\text{org}}^3} = 0.535$$

Table 6 gives the experimental results of the extraction of trivalent chromium. The extraction yield of trivalent chromium with tributyl phosphate is low. The solubility of chromium nitrate in tributyl phosphate is shown in Table 7. The solubility of chromium nitrate in tributyl phosphate rises with increasing tributyl phosphate concentration. There are 5 figures, 7 tables, and 10 references: 4 Soviet, 5 US, and 1 British.

SUBMITTED: August 11, 1959

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PHASE I BOOK EXPLOITATION

SOV/5613

Shevchenko, Viktor Borisovich, and Boris Nikolayevich Sudarikov

Tekhnologiya urana (Uranium Technology) Moscow, Gosatomizdat, 1961. 329 p.  
Errata slip inserted. 6,000 copies printed.

Ed.: M. A. Borisovskaya; Tech. Ed.: Ye. I. Mazel'

**PURPOSE:** This book is intended for students and aspirants at schools of higher education specializing in the technology of the natural radioactive elements, and can also be used by engineering, technical, and scientific workers in this and related fields.

**COVERAGE:** The book discusses technological processes in the production, dressing, and refinement of uranium ore to obtain metallic uranium and compounds of uranium used as nuclear fuel. Processing steps from the reduction of uranium ores to the refining and metallurgical stages are explained in turn. The remaining chapters deal with the chemical and physicochemical properties of the most important compounds of uranium and include a brief description of the geochemical characteristics of uranium ore. The author has based his

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## Uranium Technology

80V/5613

work on a lecture series entitled "Technology of the Natural Radioactive Elements" which he gave at the Moskovskiy ordena Lenina khimiko-tekhnologicheskii institut im. D. I. Mendeleyeva (Moscow "Order of Lenin" Institute of Chemical Technology imeni D. I. Mendeleev) from 1958 to 1960. No personalities are mentioned. There are 92 references: 20 Soviet, 70 English, 1 Italian, and 1 German.

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SHEVCHENKO, V.B.; ZHDANOV, Yu.F.

Extraction of sulfuric acid and uranyl sulfate with tributyl  
phosphate. Radiokhimiia 3 no.1:7-9 '61. (MIRA 14:3)  
(Sulfuric acid) (Uranyl phosphate) (Butyl phosphate)



S/186/61/003/002/001/018  
E037/E419

21.3200

AUTHORS: Shevchenko, V.B. and Shmidt, V.S.

TITLE: Extraction of ruthenium and other fission products with tri-n-octylamine (TOA) from nitric acid solutions

PERIODICAL: Radiokhimiya, 1961, Vol.3, No.2, pp.121-128

TEXT: The distribution coefficients of the most important radioactive fission products have been studied for extraction with TOA from nitric acid solutions. Results (determined as the ratio of  $\beta$ - or  $\gamma$ -activities of equal volumes of organic and aqueous phases) of experiments using  $\text{Ca}^{137}$ ,  $\text{Sr}^{90}$ ,  $\text{Ce}^{144}$ ,  $\text{Zr}^{95}$  +  $\text{Nb}^{95}$ , and  $\text{Ru}^{106}$  tracers are shown in Table 1, from which it can be seen that only Ru is readily extracted. The fact that elements with ions which have the greatest tendency to form nitrate complexes are best extracted with  $\text{TOA.HNO}_3$  is illustrated by Table 2 and is explained by the  $\text{TOA.HNO}_3$  being bound to the central atom of the extractable compound through the  $\text{NO}_3$  group of the  $\text{TOA.HNO}_3$ . Ruthenium has a great tendency to associate with nitrate ions and consideration of the properties of the various ruthenium nitrosyl complexes explains the fact that ruthenium is appreciably extracted  
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22991

S/186/61/003/002/001/018  
EO37/E419

Extraction of ruthenium ...

with TOA.HNO<sub>3</sub> from RuNO<sub>3</sub><sup>3+</sup> solutions (Table 1). Slow hydrolysis in aqueous nitric acid solutions yields a mixture of ruthenium nitrosonitrates, the equilibrium proportions of the individual compounds being determined by the HNO<sub>3</sub> concentration (Ref.21: O.Ye.Zvyagintsev, V.D.Nikol'skiy, S.M.Starostin, A.Kurbanov, V.S.Shmidt, Khimiya radioelementov i radiatsionnykh prevrashcheniy, 336. M. (1959). Ref.22: G.Rudstam, Acta Chem. Scand., 13, 1481 (1959). Ref.23: V.D.Nikol'skiy, V.S.Shmidt, ZhNKh, 2, 2746 (1957). Ref.24: V.D.Nikol'skiy, V.S.Shmidt, ZhNKh, 3, 2476 (1958). Ref.25: V.S.Shmidt, Thesis, IONKh, M. (1958). Ref.26: A.Jenkins, A. Wain, J.Inorg.Nucl.Chem., 3, 28 (1956) ). Preliminary TOA.HNO<sub>3</sub> extraction studies showed that 6 hours were sufficient to establish complete equilibrium. Ruthenium distribution coefficients E measured for complete equilibrium in the solution of nitrosonitrates do not reflect the extraction behaviour of the most readily extractable forms of Ru (Fig.1). This figure also illustrates the extraction behaviour for non-equilibrium conditions in the aqueous phase; it can be seen that the distribution coefficients are highest for low acidities and decrease rapidly with increasing HNO<sub>3</sub> concentration in the aqueous phase.

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Extraction of ruthenium ...

S/186/61/003/002/001/018  
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Non-equilibrium conditions were studied using freshly-prepared nitrosotrinitrate solutions for short contact times. Fig.2 illustrates Ru distribution coefficients for re-extraction (back-extraction). The distribution coefficients vary with the duration of the re-extraction and it seems that the ruthenium distribution coefficients for TOA.HNO<sub>3</sub>, as for extraction with tributylphosphate, are proportional to the distribution coefficients of the most readily extractable compounds. Fig.3 shows that the distribution coefficients of the most readily extractable Ru nitroso-compounds are proportional to the square of the TOA.HNO<sub>3</sub> concentration in the organic phase. If it is assumed that, as in the case of tributylphosphate extraction, the most readily extractable compound is RuNO(NO<sub>3</sub>)<sub>3</sub> then it follows from the data obtained that this compound goes into the organic phase as the complex RuNO(NO<sub>3</sub>)<sub>3</sub>(TOA.HNO<sub>3</sub>)<sub>2</sub>. There are 3 figures, 2 tables and 27 references: 18 Soviet-bloc and 9 non-Soviet-bloc. The four most recent references to English language publications read as follows: D.A.Carswell, I.I.Lawrence, J.Inorg.Nucl.Chem., 11, 1, 69 (1959); H.A.C.McKey, J.Inorg.Nucl.Chem., 9, 256 (1958);

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Extraction of ruthenium ...

S/186/61/003/002/001/018  
E037/R419

H.A.C. McKey, J. Inorg. Nucl. Chem., 9, 271 (1958);  
H.A.C. McKey, J. Inorg. Nucl. Chem., 9, 278 (1958).

SUBMITTED: March 30, 1960

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22992

S/186/61/003/002/002/018  
E142/E435

21,3200

AUTHORS: Shevchenko, V.B., Shmidt, V.S. and Nenarokomov, E.A.

TITLE: The extraction of  $U^{VI}$  and  $U^{IV}$  with the di-isoamyl ether  
of methyl phosphoric acid from HCl solutions

PERIODICAL: Radiokhimiya, 1961, Vol.3, No.2, pp.129-136

TEXT: During the last few years di-isoamyl ether of methyl phosphoric acid (DEMPA) has been used as a satisfactory extracting agent for uranium. The authors mention briefly their previously published results on the effectiveness of the compound and on the stability of the hexavalent uranium complex, extracted with DEMPA, as compared to the stability of the complex extracted with tributyl phosphate (TBP). The present investigation deals with the reaction mechanism of extracting  $U^{VI}$  and  $U^{IV}$  with DEMPA from HCl solutions; the stability of the uranium compounds, extracted from the HCl solutions with the two aforementioned reagents is compared. Of each reagent 20% solutions, in carbon tetrachloride, were used. Details of the preparation of uranyl chloride ( $UO_2Cl_2$ ) and of uranium tetrachloride ( $UCl_4$ ) are given. Equal volumes of the 2 phases (10 ml each) were used for the extraction process which lasted 10 minutes; this time sufficed for attaining

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The extraction of U<sup>VI</sup> and U<sup>IV</sup>S/186/61/003/002/002/018  
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equilibrium. The solution was allowed to settle for 18 hours (U<sup>VI</sup>) and 1 hour (U<sup>IV</sup>) respectively; thereafter the phases were separated. Each phase was analysed for its uranium content and the dispersion coefficient defined as the ratio of the concentrations of the element in the organic and in the aqueous phase. During the extraction of hexavalent uranium it was found that U<sup>VI</sup> is extracted to an appreciable degree with a 20% solution of DEMPA in CCl<sub>4</sub> at acidities  $> 2N$  HCl. The tetravalent element is extracted satisfactorily with 20% solutions of DEMPA and TBP in CCl<sub>4</sub> only at concentrations of HCl  $> 4 - 5 N$  HCl. The complex UO<sub>2</sub>Cl<sub>2</sub>.2DEMPA was formed in the investigated acidity range (up to 5N HCl); tetravalent uranium forms the complexes UCl<sub>4</sub>.2DEMPA and UCl<sub>4</sub>.2TBP. The ratios of the stability constants were calculated for the complexes UO<sub>2</sub>Cl<sub>2</sub>.2DEMPA and UO<sub>2</sub>Cl<sub>2</sub>.2TBP ( $113 \pm 16$ ) and for the complexes UCl<sub>4</sub>.2DEMPA and UCl<sub>4</sub>.2TBP (approximately 300). There are 4 figures, 5 tables and 7 references: 5 Soviet-bloc and 2 non-Soviet-bloc. The 2 references to English language publications read as follows: K.Kraus, F.Nelson, J.Am.Chem.Soc., 72,3901 (1950); R.Betts, R.Leigh, Canad.J.Res., 28B,514 (1953).

SUBMITTED: April 30, 1960  
Card 2/2

22485

S/186/61/003/003/003/018  
E071/E435

21.3200

AUTHORS: Shevchenko, V.B., Fedorov, I.A. and Smelov, V.S.  
TITLE: The Influence of Temperature on Extraction With Mixed Solvents of Uranyl Nitrate and Tetravalent Plutonium  
PERIODICAL: Radiokhimiya, 1961, Vol.3, No.3, pp.256-260

TEXT: The influence of temperature on the extraction of uranyl nitrate and tetravalent plutonium from 2M nitric acid solution with a mixture of diisoamyl ester of phosphoric acid (DAPh) and tertiary butyl ester of phosphoric acid (TBPh) in xylene was investigated. In the case of extraction of uranyl nitrate, the concentration of DAPh in the mixture was  $1.9 \times 10^{-3} M$  and that of TBPh was  $6.3 \times 10^{-3} M$ ; and for extraction of Pu(IV),  $2.1 \times 10^{-4} M$  and  $2.1 \times 10^{-2} M$  respectively. The concentration of uranyl nitrate in the starting solution was  $3.15 \times 10^{-4} M$ , of Pu(IV),  $1.05 \times 10^{-4} M$ . The concentration of nitric acid in starting solutions was 2M. The limits of concentrations of TBPh and DAPh in the organic solvent and of nitric acid in water were chosen in order to obtain a maximum synergetic effect. The extraction experiments were done in thermostatically controlled ( $\pm 0.1^\circ C$ ) separating funnels with Card 1/4 }

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S/186/61/003/003/003/018  
E071/E435

## The Influence of Temperature ...

10 ml starting volumes of phases and within the temperature range of 10 to 60°C. Uranium and plutonium were determined in both phases by the radiometric method. The valency state of plutonium was spectrophotometrically controlled. The coefficient of distribution  $\alpha$  was determined as the ratio of analysed concentrations of the substance investigated in the organic and aqueous phases. The synergetic effect of the mixture was defined as a ratio of the coefficient of distribution on extraction with a mixture to the sum of coefficients of distribution of the substance investigated on extraction with each individual solvent. The temperature dependence of the distribution of uranyl nitrate and tetravalent plutonium on extraction with the mixture of DAPh and TBPh (curve 1), with DAPh (curve 2) and TBPh (curve 3) is shown in Fig.1 (for uranyl nitrate) and Fig.2 (for tetravalent plutonium). Using determined values of coefficients of distribution on extraction with individual and mixed solvents, the equilibrium constants for the reaction of formation of respective mixed complexes were determined. On the basis of the experimental results obtained, it is concluded that the extractability of uranyl nitrate and plutonium (IV) with a mixture

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}



The Influence of Temperature ...

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E071/E435

of DAPh and TBPh in xylene decrease with increasing temperature from 10 to 60°C. With increasing temperature from 10 to 60°C, the equilibrium constant for the formation of mixed complex  $UO_2 [(C_5H_{11}O)_2POO]_2 TBPh$  decreased from  $2.20 \times 10^4$  to  $0.87 \times 10^4$ , while the constant for the mixed complex  $PU [(C_5H_{11}O)_2POO]_4 TBPh$  changes only a little. There are 2 figures, 2 tables and 8 references: 5 Soviet-bloc and 3 non-Soviet-bloc. The three references to English language publications read as follows: H.Irving, D.Eddington, Proc.Chem.Soc., 11, 360 (1959); T.Sato, Gall.Bull.Inst.Nucl.Sci., 7, 43 (1957); Z.Disdar, J.Inorg.Nucl.Chem., 6, 334 (1958).

SUBMITTED: May 31, 1960

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SHEVCHENKO, V. B.; SOLOVKIN, A. S.; KIRILLOV, L. M.; IVANTSOV, A. I.

Effect of saturated monoatomic alcohols and ethers on the extraction of  $\text{U}^{\text{VI}}$ ,  $\text{Pu}^{\text{IV}}$ ,  $\text{Zr}^{\text{IV}}$ ,  $\text{Ce}^{\text{III}}$ , and  $\text{Nb}^{\text{V}}$  with tri-n-butyl phosphate from nitric acid solutions. Radiokhimiya 3 no.4:35-6 '61. (MIRA 14:7)

(Extraction(Chemistry))  
(Solvents)

33184

S/186/61/003/006/003/010  
E040/E185

21.4200

AUTHORS:

Shevchenko, V.B. and Zhdanov, Yu.F.

TITLE:

Behaviour of plutonium during its extraction with amines from sulphate solutions. I. Extraction of sulphuric acid and tetravalent plutonium sulphate with n-trioctylamine (TOA)

PERIODICAL: Radiokhimiya, v.3, no.6, 1961, 676-684

TEXT: 1:1 mixtures (by volume) of the test solution and trioctylamine solvent (dissolved in carbon tetrachloride) were shaken for 5 minutes, the phases formed were separated by centrifuging and the concentrations of sulphuric acid in the aqueous and organic phases were determined volumetrically using phenolphthalein as indicator. Equilibrium concentration of plutonium was determined radiometrically. An analysis of the experimental data obtained for the extraction of H<sub>2</sub>SO<sub>4</sub> with n-trioctylamine showed that, assuming practical insolubility of TOA in the aqueous phase, TOA sulphate and bisulphate are formed in the organic phase at sufficiently high concentrations of

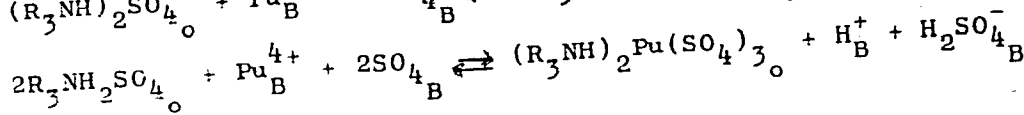
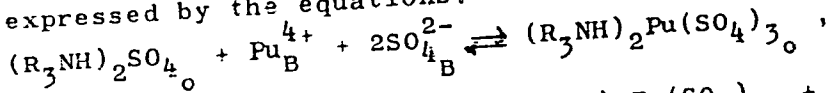
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X

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Behaviour of plutonium during its ... S/186/61/003/006/003/010  
EO40/E185

sulphuric acid. Equations are derived for the concentration of both sulphuric acid and TOA bisulphate in the organic phase. The equilibrium constants of the two compounds are, respectively,  $K = 1.18$  and  $K = 0.279 \times 10^7$ . The distribution coefficient of sulphuric acid between the two phases was found to be independent of the sulphate ion concentration, provided that the second stage of sulphuric acid dissociation can be ignored. The distribution coefficient of sulphuric acid was observed to increase with rising TOA concentration. Data are also reported for the effect of  $Li_2SO_4$  on the extraction of sulphuric acid with trioctylamine. It was assumed that the extraction process of tetravalent plutonium sulphate with n-trioctylamine can be expressed by the equations:

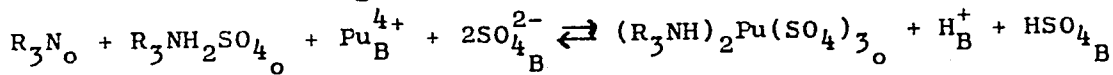
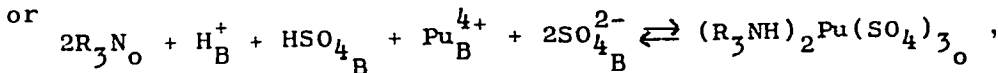


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X

33184

Behaviour of plutonium during its .. S/186/61/003/006/003/010  
EO40/E185



The value of the extraction constant, deduced by graphic method, is  $1.15 \times 10^5$ . The distribution of plutonium sulphate between the aqueous and organic phases was found to depend on the relative concentrations of the sulphate and bisulphate of TOA: the distribution coefficient diminishes with an increase in the relative concentration of TOA bisulphate. Data tabulated for the effect of sulphuric acid concentration on the distribution coefficient of plutonium sulphate show that the distribution coefficient of plutonium sulphate rises at first with increasing  $H_2SO_4$  concentration and then drops. This is thought to be due to an initial inhibition of the hydrolysis of  $Pu^{4+}$  compounds at sulphuric acid concentrations in aqueous media up to 0.1 M and, at higher  $H_2SO_4$  concentrations in the aqueous phase, the

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Behaviour of plutonium during its ... S/186/61/003/006/003/010  
E040/E185

concentration of the amine bisulphate in the organic phase tends to rise and lowers the extraction efficiency. Curves plotted for the influence of lithium sulphate on the distribution of tetravalent plutonium between the sulphuric acid and trioctylamine phases show initially a sharp rise and then a progressive reduction of the distribution coefficient of  $Pu^{4+}$ .

There are 4 figures, 4 tables and 22 references: 3 Soviet-bloc, 2 Russian translations of non-Soviet-bloc publications, and 17 non-Soviet-bloc. The four most recent English language references read as follows:

- Ref.10: C.F. Coleman, K.B. Brown, J.G. Moore, K.A. Allen. Paper at the Second Geneva Conference no.15 (P), 510, 1959.
- Ref.15: D.J. Carswell, J.J. Lawrance, J. Inorg. Nucl. Chem., v.11, 1, 69 (1959).
- Ref.16: J.L. Drumond, J.Chem.Soc., 3218 (1958).
- Ref.20: D.J. Brown, J. Colloid Sc., v.13, 3, 286 (1958).

SUBMITTED: November 21, 1960

Card 4/4

X

S/078/61/006/003/017/022  
B121/B208

AUTHORS: Shevchenko, V. B., Smelov, V. S.

TITLE: Extraction of nitrates of cerium, europium, and yttrium by dibutyl phosphate

PERIODICAL: Zhurnal neorganicheskoy khimii, v. 6, no. 3, 1961, 732-737

TEXT: Extraction of cerium, europium, and yttrium by dibutyl phosphate was studied for the purpose of separating cerium and europium from yttrium. Thiophene-free benzene was used as solvent for dibutyl phosphate. Equal volumes of the rare earth - nitrate solution and the organic phase were allowed to stand at 20°C for 15 min until equilibrium was attained. The separations were observed by means of the radioactive tracers  $Ce^{144}$ ,  $Y^{90}$ , and  $Eu^{152}$  and  $Eu^{154}$ . The distribution coefficients of trivalent cerium, europium, and yttrium were studied as a function of their concentrations; the distribution coefficients of cerium and yttrium were found to be practically independent of the concentrations. This fact confirms that cerium and yttrium do not form polymers at 0.1-2 moles/l  $HNO_3$ . The de-  
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S/078/61/006/003/017/022  
B121/B208

Extraction of nitrates of...

pendence of the distribution coefficients of trivalent cerium, yttrium and europium on the dibutyl-phosphate concentration was studied at  $\text{HNO}_3$  concentrations of 0.1 and 0.5 mole/l. It was found that the distribution coefficient decreases with reduced dibutyl phosphate concentration in the organic phase, but, increases with decreasing  $\text{HNO}_3$  concentration. A  $\text{HNO}_3$  concentration of 0.1 mole/l in the aqueous phase, and a dibutyl phosphate concentration of 0.1 mole/l in the organic phase are recommended as the optimum for the separation of cerium and europium from yttrium. Under these conditions, the distribution coefficients of the systems yttrium - cerium and yttrium - europium are  $4 \cdot 10^2$  and  $5.5 \cdot 10^2$ , respectively. The authors mention the possibility of separating rare elements into the cerium and yttrium groups by extraction with dibutyl phosphate. The equilibrium constants of the reactions of cerium and yttrium with dibutyl phosphate were calculated to be  $(3.5 \pm 0.5) \cdot 10^{-1}$  for cerium and  $(1.33 \pm 0.1) \cdot 10^2$  for yttrium. V.V. Fomin and Ye. P. Mayorova are mentioned. There are 3 figures, ✓

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Extraction of nitrates of...

2 tables, and 40 references: 13 Soviet-bloc.

SUBMITTED: August 11, 1959

S/078/61/006/003/017/022  
B121/B208

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23086

S/078/61/006/006/012/013  
B110/B206

21.3200

AUTHORS: Denotkina, R. G., Shevchenko, V. B.

TITLE: The separation of phosphate complexes from plutonium (IV) solutions

PERIODICAL: Zhurnal neorganicheskoy khimii, v. 6, no. 6, 1961, 1476-1478

TEXT: As is known, uranium (IV) and thorium form complex compounds with the ions of phosphoric acid. Since with regard to its chemical properties tetravalent plutonium is very similar to U (IV) and Th, it must form complex compounds with the phosphoric acid ions. This is confirmed by the solubility of Pu compounds in  $H_3PO_4$ . The experiments conducted by the

authors on the separation of Pu(IV)-phosphate compounds confirm their existence in the solution. A compound with good solubility in the presence of phosphate ions had to be selected for establishing the complex formation of Pu (IV). Hydroxide and doubly substituted Pu (IV)-phosphate were selected as initial substances.  $Pu(HPO_4)_2 \cdot xH_2O$  is well soluble in 3.9 and 2.8 molar  $H_3PO_4$  solutions. With the reduction of

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The separation of phosphate complexes ...

the phosphate ion concentration, the solubility of both compounds drops, however, and no complex compounds can be separated from the solutions because of the low Pu concentration. Freshly precipitated plutonium (IV) hydroxide, from which  $\text{NH}_4^+$ - and  $\text{NO}_3^-$ -ions were washed out, was dissolved at room temperature in 6 mole  $\text{H}_3\text{PO}_4$ . The doubly substituted Pu (IV)-phosphate was obtained by precipitation by 0.4 molar  $\text{H}_3\text{PO}_4$  from 1-molar plutonium solution combined with nitric acid. The precipitate washed out with 0.6 mole  $\text{HNO}_3$ ,  $\text{C}_2\text{H}_5\text{OH}$  and ether was dissolved in 6, 3.9 and 2.8 molar  $\text{H}_3\text{PO}_4$ . Pink solutions form when dissolving hydroxides and  $\text{Pu}(\text{HPO}_4)_2 \cdot x\text{H}_2\text{O}$  in  $\text{H}_3\text{PO}_4$ . The composition of the Pu(IV)-phosphate complexes in these solutions was determined by the solubility method. The precipitation of the compounds mentioned made it possible to check the composition and to investigate the properties. Ethyl alcohol was used for salting out the phosphate complexes. Gelatinous, faintly pink-colored precipitates were deposited when phosphate solutions of Pu(IV) were added to the alcohol. The precipitates freed from the mother liquor and washed out in alcohol

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S/078/61/006/006/012/013  
B110/B206

The separation of phosphate complexes ...

and ether were dried in the air thermostat for 24 hr at  $25 \pm 5^\circ\text{C}$  and in vacuum for 6 hr. The constant composition of the products prepared was achieved under the given conditions. The analysis results of the substance separated from 6 mole  $\text{H}_3\text{PO}_4$  are shown in Table 1. It can be seen therefrom that during the dissolution of the hydroxide and the doubly substituted phosphate in 6 mole  $\text{H}_3\text{PO}_4$ , a complex compound with the ratio Me : addendum = 1 : 5 is separated, which probably corresponds to the formula  $\text{H}_6 [\text{Pu}(\text{HPO}_4)_5] \cdot n\text{H}_2\text{O}$ . The analysis of the compounds separated from 2.8 - 3.9  $\text{H}_3\text{PO}_4$  produced a ratio of 1 : 5 (Table 2). The Pu(IV) complex compound with four phosphate groups was separated from the mother liquor, which was obtained during the precipitation of Pu(IV) with 1.2 and 1.6 mole  $\text{H}_3\text{PO}_4$  from its 2-molar nitric acid solution. According to Table 3, the ratio  $\text{Pu}^{4+} : \text{HPO}_4^{2-} = 1 : 4$ . This composition corresponds to  $\text{H}_4 [\text{Pu}(\text{HPO}_4)_4] \cdot n\text{H}_2\text{O}$ . Studies of the electromigration of Pu(IV) confirm the existence of complex acids. Pu(IV) complex compounds with five

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The separation of phosphate complexes ...

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B110/B206



phosphate groups probably exist in 6, 3.9 and 2.8 molar  $H_3PO_4$ , and those with four groups in 1.2 and 1.6 molar  $H_3PO_4$ . The complex with the ratio Me : addendum = 1 : 3 could not be separated. The solid phosphate complexes are amorphous pink substances, well soluble in  $HNO_3$  and  $HCl$ , insoluble in alcohol, hexane, ether, acetone and carbon tetrachloride. After six months storage they still had the original ratio  $Pu^{4+} : HPO_4^{2-}$  and were hydrolyzed in water. [Abstracter's note: Essentially complete translation.] There are 4 tables and 5 references: 1 Soviet-bloc and 4 non-Soviet-bloc. The references to the English-language publications read as follows: Ref. 1: E. L. Lebroski, H. W. Abter, F. K. Neuman, J. Amer. Chem. Soc., 73, 5646 (1951). Ref. 2: J. M. Schreyer. J. Amer. Chem. Soc. 77, 2972 (1955). Ref. 3: R. P. O'Connor. Report CN, 1702, June, 1944.

SUBMITTED: November 3, 1960

Card 4/6

SHRUCHENKO, V.B.; SHELLOV, V.S.

Effect of temperature on the distribution of mono- and dibutyl  
phosphoric acids between benzene and water. Ekstr.; teor., prim., -  
app. no. 2:58-62 '62. (MIRA 15:9)  
(Phosphoric acid) (Solvents)

SHEVCHENKO, V.B.; SNELOV, V.S.; STRAKHOVA, A.V.

Synergism in the extraction of uranyl nitrate. Ekstr.; teor.,  
prim., app. no. 2:179-189 '62. (MIRA 15:9)  
(Uranyl ~~n~~itrate) (Extraction (Chemistry))

SHEVCHENKO, V.B.; SMELOV, V.S.

Effect on mono- dibutyl phosphates on the extraction of uranium (VI)  
by tributyl phosphate. Ekstr.; teor., prim., app. no. 2:219-226 '62.  
(MIRA 15:9)

(Uranium) (Butyl phosphate)



SHENCHENKO, V.B.; SHELLOV, V.S.

Problem of the extraction of fission products by mono- and  
dibutyl phosphates. Ekstr.; teor., prim., app. no. 2:257-263 '62.  
(MIRA 15:9)

(Fission products) (Butyl phosphate)  
(Extraction (Chemistry))

h0110  
S/078/62/007/007/012/013  
B119/B101

4700  
AUTHORS: Shevchenko, V. B., Smelov, V. S., Strakhova, A. V.

TITLE: Extraction of uranium by a binary reagent mixture

PERIODICAL: Zhurnal neorganicheskoy khimii, v. 7, no. 7, 1962, 1736 - 1742

TEXT: The authors studied extraction of uranyl nitrate from aqueous solutions by binary mixtures of diisoamyl ester of phosphoric acid (I), monoisoamyl ester of methyl phosphinic acid (II) (acid components), tributyl phosphate (III), diisoamyl ester of methyl phosphinic acid (IV), and tributyl phosphinic oxide (V) (neutral components). The diluents used for the organic phase were carbon tetrachloride, chloroform, tridecane, octane, benzene, xylene, tri-1, 2, 3-propyl benzene, as well as the high-boiling fraction of hydrogenated kerosene (both in its crude state and rehydrogenated and redistilled).  $U^{233}$  was used in concentrations of  $\sim 10^{-4}$  moles/liter. The method of investigation was as described by the authors earlier. (Sb. po ekstraktzii, (Collection on Extraction) Atomizdat, 1962).  
Results: for the extraction with II + III the maximum values of the synergetic extraction effect S were shown to occur with 8 to 10 times as much of II present in benzene solution as required to form

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AP5027204

.../EWP(t)/EWP(b) LJP(c) JD

AUTHOR: Denotkina, R. G.; Shevchenko, V. B.; Moskvin, A. I. SOURCE CODE: UR/0078/65/010/011/2449/2452

21  
B

ORG: None

TITLE: The solubility product of ammonium plutonyl phosphate in aqueous solutions

SOURCE: Zhurnal neorganicheskoy khimii, v. 10, no. 11, 1965, 2449-2452

TOPIC TAGS: ammonium phosphate, plutonium compound, solubility

ABSTRACT: Ammonium plutonyl phosphate was precipitated by the reaction of a 0.1 molar nitric acid plutonyl solution with an  $8.26 \times 10^{-3}$  molar concentration of the metal and a 1.0 molar solution of  $(NH_4)_2HPO_4$ . The finely crystalline precipitate obtained, which was of a light green color and had the composition  $NH_4PuO_2PO_4 \cdot 3H_2O$ , was the starting material for the investigations. The solubility of ammonium plutonyl phosphate was determined in aqueous solutions over the pH range from 1.0 to 6.4. In one series of experiments the pH of the solutions was adjusted by addition of  $HClO_4$ , and in another series of experiments by addition of  $HNO_3$ . The ionic strength in the solution was not constant, since addition of  $NaClO_4$  or  $LiNO_3$  to maintain  $\mu$  constant brought about partial replacement of the  $NH_4$  group by sodium or lithium ions, as a

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UDC: 546.799.4:39:185

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Card 2/2

AYRUNI, Arsen Tigranovich, kand. tekhn. nauk; ALESSEYEV, Viktor Borisovich;  
BURSHTEYN, Mark Aleksandrovidh; GEYMAN, Leonid Mikhaylovich;  
GRABILIN, Yuriy Nikolayevich; KILIMOV, Sergey Leonidovich; SOSNOV,  
Vladimir Dmitriyevich; SENCHEVA, Valentina Ivanovna; SUYSTIN,  
Georgiy Georgiyevich; FEYGIN, Lev Mikhaylovich; SHEVCHENKO, Vadim  
Dmitriyevich; KAZAKOV, B.Ye., otv. red. toma; TAYTS, T.L., red.;  
OSVAL'D, E.Ya., red. izd-va; MINSKER, L.I., tekhn. red.

[The coal industry of capitalist countries]Ugol'naiia promyshlennost' kapitalisticheskikh stran. Moskva, Gos.nauchno-tekhn.izd-vo lit-ry po gornomu delu. Vol.2.[Technology, mechanization, and organization of development workings]Tekhnologiya, mekhanizatsiia i organizatsiia rabot pri provedenii podgotovitel'nykh gornykh vy-rabotok. Otv. red. toma: B.E.Kazakov, V.D.Sosnov, G.G.Suetin. 1962. 351 p. (MIRA 16:2)

1. Moscow. TSentral'nyy institut tekhnicheskoy informatsii ugol'noi promyshlennosti. 2. TSentral'nyy institut tekhnicheskoy informatsii ugol'noy promyshlennosti, Moscow(for Suetin, Sencheva). 3. Gosudarstvennyy proyektnyy institut po avtomatizatsii ugol'noy promyshlennosti (for Feygin). 4. Gosudarstvennyy komitet Soveta Ministrov SSSR po avtomatizatsii i mashinostroyeniyu (for Sosnov). 5. Vsesoyuznyy tsentral'nyy proyektnyy institut po proyektirovaniyu shakhtnogo stroitel'stva kamennougol'noy promyshlennosti (for Burshteyn, Shevchenko). 6. Gosudarstvennoye nauchno-tekhnicheskoye izdatel'stvo po ugol'noy promyshlennosti(for Geyman).

(Continued on next card)

SHEVCHENKO, V.D.; SHKLYAR, L.A., kand. tekhn. nauk, red.;  
VAGAPOV, E.A., red.

[Learn how to drive a car] Uchites' upravliat' avtomob-  
ilem. Kazan' Tatarskoe knizhnoe izd-vo, 1965. 194 p.  
(MIRA 18:10)

SHEVCHENKO, V.D., inzh.; PERMYAKOV, Yu.V., inzh.

Using the SKG-30 track-laying crane with 55m. guying crane arm.  
Prom. stroi. 41 no.10:49-50 0 '63. (MIRA 16:11)

SHEVCHENKO, V.D.; SELITSKIY, F.I.

Use of epoxy resins for the correction of founding defects.  
Lit. proizv. no.12:33 D '61. (MIRA 14:12)  
(Founding--Defects)  
(Epoxy resins)

SHEVCHENKO, V.D. (Kiyev)

Equations for calculating shallow shells. Prykl.mekh. 8 no.4:368-  
371 '62. (MIRA 15:9)

1. Kiyevskiy avtomobil'no-dorozhnyy institut.  
(Elastic plates and shells)



ACCESSION NR. AP3005543

3/0198/63/009/004/0367/0373

AUTHOR: Shevchenko, V. D.

TITLE: The effect of certain geometric parameters on the stress-deformed state of shallow shells

SOURCE: Prikladna mekhanika, v. 9, no. 4, 1963, 367-373

TOPIC TAGS: shallow shell, sag force, net, finite difference, bulge, coefficient

ABSTRACT: The author uses two methods to find values for sags and forces (which are shown to depend on the coefficient of bulge of the shell): the method of finite differences and the method of nets. When the thickness of the net is increased, the accuracy of the values for sags and forces are greater, and it is shown that an accuracy greater than 5% is obtained using a 6 x 6 net. Considerations are presented as to the shallowness of the shell.

The method of finite differences is used to find the dependence of sags, forces, and moments of hinged shells on the coefficient of bulge for three cases:  $\beta = 1.0$ ,  $\beta = 1.5$ ,  $\beta = 2.0$ , (see figures 1,2,3). The author draws a comparison with moment-less theory.

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*Kiev avtodorozhnyy inst.*

4094-65 EWT(d)/EWT(m)/EWP(w)/EWA(d)/EWP(v)/EWP(k)/EWA(h) PF-4/Peb EM  
ACCESSION NR: AP5007268 S/0198/65/001/002/0056/0061

AUTHOR: Shevchenko, V. D. (Kiev)

TITLE: Nonlinear flexure problem of a shallow shell 26

SOURCE: Prikladnaya mekhanika, v. 1, no. 2, 1965, 56-61

TOPIC TAGS: shallow shell, shell flexure, shallow shell flexure

ABSTRACT: The solution of the problem of flexure of a shallow shell in nonlinear formulation by the method of finite differences combined with an iteration method is presented. V. Z. Vlasov's system of nonlinear differential equations is reduced (by means of finite-difference relationships) to a system of nonlinear algebraic equations to which the linear theory of shallow shells can be applied. The procedure of solution by using an iteration method is outlined. The range of application of the linear theory is discussed by comparing the results obtained by applying nonlinear and linear theories to shells with various depth and rigidity parameters. The problem is solved on an electronic computer for simply supported and hinged shells having the

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ACCESSION NR: AP5007268

form of an elliptic paraboloid, and the deflections in the center of the shell are determined and shown in diagrams. Orig. art. has: <sup>2</sup> figures, 1 table, and 14 formulas. [VK]

ASSOCIATION: Kiyevskiy avtodorozhnyy institut (Kiev Highway Institute)

SUBMITTED: 03Apr64

ENCLOSURE: 00

SUB CODE: AS

NO REF SOV: 003

OTHER: 000

ATD PRESS: 3209

Card 2/2

SHEVCHENKO, V.D. (Kiyev)

Nonlinear problem of the bending of a shallow shell. Prikl.  
mekh. 1 no.2:56-61 '65. (MIRA 18:6)

1. Kiyevskiy avtodorozhnyy institut.

SHVETSHIKOV, V. P.

"Equation of the Acceleration of an Automobile Taking Into Account the Changes in the Characteristics of the Engine During Acceleration," Sb. statey Chelyabinskogo politekhn. in-ta. No 1, pp 79-84, 1954

The significances of theoretical and experimental accelerations during various speeds of the automobile are presented in graphs. (REKZhKh, No 5, May 55)

Suz. No. 161, 7 Oct 55

VOSKRESENSKIY, B.V.; MIRONOV, N.P.; SHEVCHENKO, V.F., mekhanik

Production of high-quality engineering lime. Stroi. mat. 5 no.4:22-24  
Ap '59. (MIRA 12:6)

1. Glavnyy inzhener Chelyabinskogo zavoda ferrosplavov (for Voskresenskiy).
2. Nachal'nik tsekha Chelyabinskogo zavoda ferrosplavov (for Mironov).  
(Chelyabinsk--Lime)

SHEVCHENKO, V.F.

Machine tool for punching sheet steel. [Suggested by: V.F. Shevchenko].  
Rats. i izobr. predl. v stroi. no.142:14-16 '56. (MIRA 10:4)  
(Punching machinery)

SHEVCHENKO, V.F.

Using sheet steel waste instead of angle steel in making fitting frames. [Suggested by: V.F. Shevchenko]. Rats. i izobr. predl. v stroi. no.142:39-41 '56. (MIRA 10:4)  
(Ventilation)



SHEVCHENKO, V.F.

Manufacturing frameless air-regulating vents to be used for air  
curtains. Rats. i izobr. predl. v stroi. no.3:83-85 '57.(MIRA 11:1)  
(Air curtains)

*SHEVCHENKO, V.F.*

SHEVCHENKO, V.F.

Manufacturing strainers to be used in oil filters. Rats. 1 izobr.  
predl. v stroi. no.3:85-88 '57. (MIRA 11:1)  
(Oil filters)

SHEVCHENKO, V.P.

Manufacturing frameless air vents to be used in the V.V. Baturin  
system. Rats. i izobr. predl. v stroi. no.3:88-90 '57. (MIRA 11:1)  
(Factories--Heating and ventilation)

~~ШЕВЧЕНКО, В.Ф.~~  
SHEVCHENKO, V.F.

Manufacturing frameless air vents to be used in crane cabs. Rats.  
i izobr. predl. v stroi. no.3:90-91 '57. (MIRA 11:1)  
(Cranes, derricks, etc.) (Ventilation)