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SCIENTIFIC INFORMATION REPORT

Chemistry and Metallurgy

(27)

Summary No. 4460

4 April 1963

Prepared by

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SCIENTIFIC INFORMATION REPORT

Chemistry and Metallurgy (27)

This is a serialized report consisting of unevaluated information prepared as abstracts, summaries, and translations from recent publications of the Sino-Soviet Bloc countries. It is issued in seven series. Of these five, Biology and Medicine, Electronics and Engineering, Chemistry and Metallurgy, Physics and Mathematics, and Organization and Administration of Soviet Science, are issued monthly. The sixth series, Chinese Science, is issued twice monthly; and the seventh series, Outer Mongolia, is issued sporadically. Individual items are unclassified unless otherwise indicated.

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I. CHEMISTRY

Aerosols and Mists

1. Accelerated Coagulation of Aerosols in the Presence of Shock Waves Unexplained

"Coagulation of Aerosols Under the Effect of Periodic Shock Waves," by A. I. Gulyayev and V. M. Kuznetsov, Institute of Physical Problems imeni S. I. Vavilov, Academy of Sciences USSR, Moscow; Moscow, Akusticheskiy Zhurnal, Vol 8, No 4, Oct-Dec 62, pp 473-375

During the course of research on high-amplitude resonances vibrations, conducted under the supervision of P. L. Kapitsa, an accelerated coagulation of aerosols in the closed space was noticed in the presence of shock waves. In spite of a detailed study, the question of the mechanism of coagulation under such conditions remains open, since it is not clear what the main reason for the accelerated coagulation is, i.e., whether it is the main shock wave, the oblique shocks, or turbulence.

2. Mist Dispersion Studied

"Dispersion of a Fog Formed During Condensation of Vapors on a Surface," by A. G. Amelin and Ye. V. Yashke, Scientific Institute for Fertilizers and Insectofungicides; Moscow, Kolloidnyy Zhurnal, Vol 25, No 1, Jan/Feb 63, pp 3-8

A study was made of the dispersion of fogs formed during condensation of sulfuric acid vapors on surfaces. It was shown that the particle size of the fog increases as the temperature of the condensation surface increases and as the velocity of the gas stream decreases. Experimental data were correlated with theoretical data, and a previously described method for calculating dispersion is now recommended for practical use. This correlation also confirmed theoretical formulas for the rate of nucleus formation.

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Organophosphorus Compounds

3. Action of Chloral on Alkyl Esters of Phosphonic Acids Studied

"Action of Chloral on the Alkyl Esters of p-Chlorophenyl-, p-Isopropylphenyl-, and alpha-naphthylphosphonic Acids," by G. Kh. Kamay, F. M. Kharrasova, R. B. Sultanova, and S. Yu. Tukhvatullina, Kazan Chemicotechnological Institute imeni S. M. Kirova; Ivanovo, Izvestiya Vysshikh Uchebnykh Zavedeniy -- Khimiya i Khimicheskaya Tekhnologiya, Vol 5, No 5, 1962, pp 759-762

A study shows that chloral reacts with alkyl esters of p-chlorophenyl-, p-isopropylphenyl-, and alpha-naphthylphosphonic acids to form mixed beta, beta-dichlorovinyl esters of the corresponding p-chlorophenyl-, p-isopropylphenyl-, and alpha-naphthylphosphonic acids. Ten products were obtained and their physical constants determined and presented in a table.

4. Soviet Patent on Method of Preparation of Organophosphorus Compounds

"Method for Preparing Mixed Anhydrides," by A. A. Skladnev, A. V. Fokin, and Yu. N. Studnev, Author's Certificate No 145574, filed 21 March 1962 (from Referativnyi Zhurnal -- Khimiya, No 2, 25 Jan 63, Abstract No 2N271, by A. Ryshka)

"Mixed anhydrides of monoesters of the formula $R''C(S)OP(O)R'(OR)$ (I) (where R = alkyl, R' = OR or R, R'' = $CDClH$ or CF_2H) are obtained by treating monoesters of methylphosphonic acid or diesters of phosphoric acid with equimolecular quantities of difluoro- or fluorochloro-substituted alpha, alpha-difluoroethylmercaptan in an inert solvent with the use of KF as a dehydrofluorinating agent. A mixture of 50 ml of absolute C_6H_6 , 13.8 grams O-isopropylmethylphosphonic acid, and 15.1 grams 2-chloro-2-hydrotrifluoroethylmercaptan is left standing for 3 hours. To the solution 11.6 grams of calcined KF is added, and the mixture is left standing over night. The precipitate is filtered, the solvent is distilled off under vacuum, and the residue is fractionated. The product (I) (R = iso- C_3H_7 , R' = CH_3 , R'' = $CFClH$) has a yield of 85%, boiling point $60-61^\circ / 10 \text{ mm}$, n_D^{20} 1.4649, d_4^{20} 1.2980. Other derivatives were prepared. The product is useful as an insecticide."

5. Diazophosphonic Acid Esters Prepared

"Diazophosphonic and Hydrazodiphosphonic Acid Esters,"
by A. N. Pudovik, T. M. Moshkina, and V. P. Khramtsova,
Kazan Branch Scientific-Research Cinefoto Institute;
Moscow, Zhurnal Obshchey Khimii, Vol 33, No 1, Jan 63,
pp 94-97

Seven dialkyl esters of diazophosphonic acids were prepared by diazotization of dialkylphosphoric or diethylthiophosphoric acids. These compounds were used to prepare phenyl-, p-tolyl-, and p-nitrophenyl-diazophosphonic acid esters. Nine esters of substituted hydrazine-phosphonic acids were also prepared.

6. Reactions of Acid Chlorides With Salts of Dialkylphosphorous Acids Studied

"Reactions of Carboxylic Acid Chlorides and Anhydrides With Sodium Diethylphosphide," by A. N. Pudovik and I. V. Kononova, Kazan State University; Moscow, Zhurnal Obshchey Khimii, Vol 33, No 1, Jan 63, pp 98-102

A study was made of the reactions of carboxylic acid chlorides and anhydrides with sodium diethylphosphide, and a reaction mechanism was proposed. These reactions result in the formation of corresponding (alpha-diethylphosphon) alkylphosphonates. Acetyl chloride reacts with methyl di(diethylphosphon)carbinol to form the acetate. The products were identified by infrared absorption spectra.

7. Polyphosphites Synthesized From Glycols

"Polyphosphites, IV. Reactions of Dialkylphosphorous Acid Chlorides With Glycols," by A. N. Pudovik, I. M. Aladzheva, I. A. Sokolova, and G. A. Kozlova, Kazan State University; Moscow, Zhurnal Obshchey Khimii, Vol 33, No 1, Jan 63, pp 102-107

A number of alkylene glycol diphosphites and thiodiglycol diphosphites were synthesized by reactions of corresponding dialkylphosphorous acid chlorides with glycols. Tetraethyl-1,2-propyleneglycol diphosphite undergoes disproportionation by an intermolecular mechanism, while esters of 1,4-butyleneglycol diphosphites and diethyleneglycol diphosphites chiefly follow an intramolecular mechanism. Alkylene glycol diphosphites react with sulfur by addition to form dithiodiphosphate esters. Esters of corresponding diphosphonates are formed by heating alkylene glycol diphosphites with alkylhalides.

8. Organophosphorus Dicarboxylic Acids Synthesized

"Synthesis of Phosphorus-Containing Aliphatic Dicarboxylic Acids," by Ye. V. Kuznetsov, R. K. Valetdinov, and Ts. U. Roytburd, Kazan Chemisotechnological Institute imeni S. M. Kirov; Moscow, Zhurnal Obshchey Khimii, Vol 33, No 1, Jan 63, pp 150-153

A study shows that bis-beta-cyanoethylphosphine hydrolyzes in acid medium to form bis-beta-carboxyethylphosphonous acid; in alkaline medium, it forms bis-beta-carboxyethylphosphonic acid. The following three phosphorus-containing monomers were synthesized for the first time: bis-beta-carboxyethylphosphonous acid, bis-beta-carboxyethylphosphonic acid, and bis-beta-carboxychloroethylphosphonic acid chloride.

9. Acidolysis of Phenyldichlorophosphazoaryls Studied

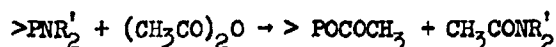
"Acidolysis of Monomeric and Dimeric Phenyldichlorophosphazoaryls," by I. N. Zhmurova and A. V. Kirsanov, Institute of Organic Chemistry, Academy of Sciences USSR; Moscow, Zhurnal Obshchey Khimii, Vol 33, No 1, Jan 63, pp 182-188

Acidolysis of monomeric phenyldichlorophosphazoaryls results in the formation of monoarylide chlorides of phenylphosphonic acid. Dimeric phenyldichlorophosphazoaryls, monomerized by boiling in benzene, also form monoarylide chlorides of phenylphosphonic acid on acidolysis. If dimeric phenyldichlorophosphazoaryls are treated with formic acid without preliminary monomerization, polymeric anhydroaryliminophenylphosphonic acids are formed.

10. New Method for Preparation of Acetyl Phosphites or Phosphonites

"Reaction of Amidophosphites and Amidophosphonites With Acid Anhydrides," by M. I. Kabachnik, T. A. Mastryukova, and A. E. Shipov; Moscow, Zhurnal Obshchey Khimii, Vol 33, No 1, Jan 63, pp 320-321

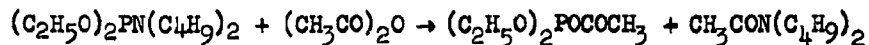
It was observed that dialkyl acid amides of trivalent phosphorus acids of the types $(RO)_2P-NR_2$ and R_2P-NR_2 react with acetic anhydride to form corresponding acetyl phosphites or acetyl phosphonites with high yields.



Acetyl phosphites are intermediates in peptide synthesis. Until now, their methods of preparation were based on reactions of pyrophosphites or chlorophosphites with carboxylic acids or their salts.

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The authors carried out the above new reaction with dibutylamido-diethylphosphite and acetic anhydride:

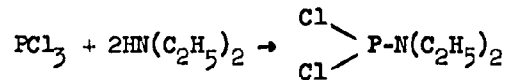


The resulting acetyl phosphite was treated with sulfur to give diethyl-acetylthiophosphate to prove the structure.

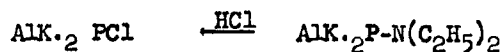
11. Trifluoro Derivatives of Phosphorus Synthesized

"Synthesis of Some 3,3,3-Trifluoropropyl Derivatives of Phosphorus," by M. A. Larionova, A. L. Klebanskiy, and V. A. Bartashev, All-Union Scientific-Research Institute of Synthetic Rubber imeni S. V. Lebedev; Moscow, Zhurnal Obshchey Khimii, Vol 33, No 1, Jan 63, pp 265-266

Bis(-3,3,3-fluoropropyl)thiophosphoric acid and its derivatives were prepared. The known method for preparing these compounds by sulfur addition to the Grignard reagent gives low yields. Therefore, a new method was used which gave higher yields.



Alk.MgCl



12. Silicon Organophosphorus Compounds Prepared

"Study of Reactions of Dialkyldichlorosilanes and Alkyltrichlorosilanes With Potassium Dihydroxyphosphate," by A. P. Kreshkov, D. A. Karateyev, V. Fyurst, and E. N. Pavlova, Moscow Chemicotechnological Institute imeni D. I. Mendeleev; Moscow, Zhurnal Obshchey Khimii, Vol 33, No 1, Jan 63, pp 261-265

A study was made of the reactions of methyl and ethyl trichlorosilanes and dimethyl-, diethyl, and methylvinylchlorosilanes with potassium dihydroxyphosphate. These reactions take place in absolute ether to form silicon organophosphorus compounds with yields of 85-95%. The following five compounds were prepared for the first time: ethylphosphatemethylsilyldiphosphoric acid, ethylphosphateethylsilyldiphosphoric acid, dimethylsilyldiphosphate, diethylsilyldiphosphate, and methylvinylidiphosphate.

Pesticides

13. New Contact Insecticides Developed

"The New Contact Pesticides Efiran-168 and Efiran-169," by Shamkhal Mamedov, O. B. Osipov, T. N. Dzhalliliv, and Ye. N. Grishina; Baku, Doklady Akademii Nauk-Azerbaydzhanskoy SSR, Vol 18, No 9, 1962, pp 19-23

Two new insecticides and acaricides were synthesized which have polyglycol ester groups as the active agents. The preparations are named Efiran-168 and Efiran-169. It was further established that the accumulation of acetal oxygen in the molecule intensifies insecticidal activity. In 0.25% concentrations, both Efiran-168 and Efiran-169 are active against a number of sucking plant pests. They are also nontoxic to mammals.

14. Toxicity of M-81 Tested

"Toxicity of Formulation M-11 on Certain Sucking Insects," by N. M. Gamper, Byul. Vses. N.-I. In-ta Zashchity Rast., No 5, 1961, pp 30-33 (from Referativnyy Zhurnal -- Khimiya, No 2, 25 Jan 63, Abstract No 2N239, by A. Ryshka)

"A study was made of the action of a 50% concentration of M-81 [O,O-dimethyl-S-(beta-ethylmercapto)-ethylthiophosphate] on apple plant lice Psylla mali, green apple aphids Aphis pomi, and cobweb ticks Tetranychus telarius. M-81 is a highly toxic insecticide functioning from within the plant and is similar to mercaptophos in toxicity and lasting effects, but is less toxic toward warm-blooded animals and humans."

15. Soviet Patent on Insecticides

"Method of Preparation of Insecticides," by N. N. Mel'nikov, Ya. A. Bakanova, and Z. M. Zaks, USSR Author's Certificate No 145086, filed 26 February 1963 (from Referativnyy Zhurnal -- Khimiya, No 2, 25 Jan 63, Abstract No 2N276, by A. Ryshka)

"Compounds having the general formula (RO) (R'O) P (S) OC₂H₄SC₂H₅ (I) (where R = alkyl, R' = aryl) are prepared by reaction of O,O'-alkylarylchlorothiophosphate with beta-oxyethylmercaptoethyl sulfide in the presence of aqueous alkali. While conducting the reaction, OP-7 may be used as an emulsifier. To a mixture of 15.7 grams O-phenyl-methylchlorothiophosphate and 8 grams beta-oxydiethylsulfide, 4.5 grams of NaOH (40% solution) are added gradually at 15°. The mixture is agitated for 3-6 hours at 20-30°, diluted with water, and the oily phase is then separated and dried. The product (I) (R = CH₃, R' = C₆H₅) has a refractive index of 1.5540 and density of 1.2150, and the yield is 60-80%. Other derivatives are prepared analogously."

16. New Weed Killer Synthesized

"Preparation of Macromolecular Herbicides," by Z. Volkober and I. S. Varga, Scientific-Research Institute of the Plastics Industry, Budapest; Moscow, Vysokomolekulyarnyye Soyedineniya, Vol 5, No 1, Jan 63, pp 139-144

A new polyvinyl alcohol (PVA) derivative, 2,4-dichlorophenoxyacetic ester of PVA, was synthesized. The reaction was carried out in the molten state. Cellulose di- and triacetates were treated with 2,4-D

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in the molten state. Optimum conditions for preparation of the 2,4-D ester of PVA containing up to 60-65 mole percent ester groups were established. The herbicidal properties of the products were confirmed by biological tests.

Rare Metals and Gases

17. Extraction of Tetravalent Uranium With Tridecylamine Fluoride

"The Mechanism of Extracting U^{+4} With Tridecylamine Fluoride Solutions," by V. M. Vdovenko, A. A. Lipovskiy, and S. A. Nikitina; Leningrad, Radiokhimiya, Vol 4, No 6, 1962, pp 625-632

The mechanism of extracting U^{+4} from HF and NaF solutions with the use of tridecylamine (TDAN) fluoride was investigated.

Spectrophotometric analysis showed that in organic solutions, complex compounds (TDAN) UO_2F_3 and (TDAN) $_2UO_2F_4$ were formed. The composition of these complexes was also established from equilibrium constants. No compounds with a ratio of F/U > 4 were found to exist.

An investigation of the extraction of uranyl fluoride from aqueous solutions with tridecylamine fluoride showed that UO_2F_2 combines with one or two molecules of tridecylamine fluoride. Better results were obtained in the extraction process when the excess of fluoride ions was kept at a minimum.

18. Adsorption Characteristics of Plutonium on Glass and Quartz

"Adsorption of Tetravalent Plutonium on Glass and Quartz," by A. G. Samartseva; Leningrad, Radiokhimiya, Vol 4, No 6, 1962, pp 647-655

The adsorption of Pu^{+4} on glass and polished quartz in relation to the hydrogen ion concentration for three different concentrations of plutonium was studied. It was found that at lower hydrogen ion concentrations, adsorption of plutonium increases to a sharp maximum. Adsorption of plutonium on quartz was noted to be considerably greater than on glass, although the shapes of the adsorption curves for both glass and quartz remained completely identical.

The adsorption of plutonium on the same materials was also investigated with respect to the concentration of plutonium in the solution. It was observed that with decreased concentration of

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Pu^{+4} in solution from 10^{-8} to 10^{-10}M , the adsorption maximum was shifted toward the higher pH values. This shift was explained by the formation of true plutonium colloids in the solution as a result of reaching the pH value for the solubility of plutonium hydroxide.

A study of plutonium desorption showed that at $\text{pH} < 4$ a marked reversible process ensued, whereas with $\text{pH} > 4$ the process was less reversible. The formation of true plutonium colloids was estimated to occur at $\text{pH} \approx 3$.

19. Extraction of Americium From Various Acid Solutions With DAMFK

"Study of the Complex Formations of Americium With the Diisooamyl Ester of Methylphosphonic Acid (DAMFK)," by V. I. Zemlyanukhin, G. P. Savoskina, and M. F. Pushlenkov; Leningrad, Radiokhimiya, Vol 4, No 6, 1962, pp 655-660

Previous studies showed that DAMFK is a better extractor of uranium and plutonium than tributyl phosphate. Therefore, it was decided to study the complex formations of trivalent americium with DAMFK when extracted from nitric, hydrochloric, perchloric, sulphuric, and acetic acid solutions.

It was shown that complexes formed from americium and DAMFK follow the same principles as americium with tributyl phosphate. Americium was found to have comparatively high distribution coefficients when extracted with DAMFK from nitric and hydrochloric acid solutions, but was extracted only slightly from perchloric, sulphuric, and acetic acid solutions.

20. Study of Thorium-Dihydroxycarboxylic Acid Complexes

"A Study of the Complex Formations of Thorium With Some Dihydroxycarboxylic Acids," by A. V. Lapitskiy, I. Geletseanu, and M. Beran; Leningrad, Radiokhimiya, Vol 4, No 6, 1962, pp 672-677

The ion-exchange method was used to study complex compounds of thorium with malic, trioxylglutaric, and tartaric acid solutions.

Initially, the adsorption of thorium on Dowex-50 cation resin was studied to determine the proper pH range for investigating thorium complexes. Maximum adsorption of thorium was found to occur at $\text{pH}=2$, and it was also noted that thorium under these conditions exists as a nonhydrolyzed Th^{+4} ion.

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Thorium formed complexes with the above three acids with a 1:1 Th/acid ratio. The instability constant for these complexes was found to be of the order 10^{-6} mole/l. A second complex with a 1:2 Th/acid ratio was observed in the case of malic acid which had an instability constant of $10^{-7}(\text{mole})^2/(\text{liter})^2$. The instability constants for these complexes were calculated according to the formulas:

$$K_1 = \frac{\gamma_+}{1 - \gamma_+} \frac{[\text{HA}^-]}{[\text{Th}^{4+}]} \quad \text{for the 1:1 complexes}$$

and

$$K_2 = \frac{\gamma_+^2}{1 - \gamma_+^2} \frac{[\text{HA}^-]^2}{[\text{Th}^{4+}]} \quad \text{for the 1:2 complex,}$$

where γ_+ is the mean (molal) ionic activity coefficient and $[\text{HA}^-]$ is the molal concentration of acid.

The mean effective charge for the thorium-malic acid complex was determined to be 10, from which it was concluded that in a system which forms a mixture of multinuclear complex cations, the general formula for the complexes will be $[\text{Th}(\text{C}_4\text{O}_5\text{H}_6)]_n^{2n+}$ or $[\text{Th}(\text{C}_4\text{O}_5\text{H}_6)_2]_n^{2n+}$.

21. Extraction of Zirconium and Hafnium With Cyclohexanone

"Extraction Method of Separating Zirconium and Hafnium From Sulphuric Acid Solutions With Cyclohexanone," by D. L. Motov and T. G. Leshtayeva, Institute of Chemistry and Technology of Rare Elements and Minerals, Kola Affiliate, Academy of Sciences USSR; Ordzhonikidze, Izvestiya Vysshikh Uchebnykh Zavedeniy -- Tsvetnaya Metallurgiya, No 5, 1962, pp 113-121

Without the addition of complex-forming reagents, cyclohexanone will not extract zirconium or hafnium from sulphuric acid solution. Results of testing a whole series of inorganic and organic compounds showed that only thiocyanides, specifically ammonium thiocyanide, give satisfactory results when used with cyclohexanone.

Optimum conditions for the separation of hafnium and zirconium from the acid into the organic phase were determined which will extract 95-97.5% hafnium. The percent of zirconium extracted is not mentioned.

This method can be used with the same success that was previously used in extracting niobium and tantalum, both in chemical analysis and industrial technology.

22. Investigation of Uranium-Nitric Acid Reactions

"Some Data Concerning the Behavior of Uranium in Nitric Acid," by N. P. Yemolayev and N. N. Krot; Leningrad, Radiokhimiya, Vol 4, No 6, 1962, pp 678-685

There has been some information published about the complex compounds formed by reacting nitric acid with tetravalent thorium (Th^{+4}) and plutonium (Pu^{+4}), but nothing has been published concerning tetravalent uranium (U^{+4}) and nitric acid. For this reason, ion-exchange and spectrophotometric investigations were made on the behavior of U^{+4} with the nitrate (NO_3)⁻¹ ion.

Calculation of the absorption coefficients and molar absorptivities of the products formed in the oxidation of uranium in varying molar concentrations of nitric acid established that the reaction is self-catalyzed and accelerated by the reduction products of the nitrate ions.

Oxidation of uranium and formation of complexes was found to be a step-by-step process dependent on the molar concentration of acid. If monovalent anions were present in solution, compounds having the general formula $\text{M}_2\text{U}(\text{NO}_3)_6$ were observed where M indicates ions of cesium, rubidium, ammonium, piperidine, or quinoline.

23. Thermodynamic Properties of Francium and Its Compounds

"Thermodynamic Properties of Some Francium Compounds,"
by G. A. Krestov; Leningrad, Radiokhimiya, Vol 4, No 6,
1962, pp 685-690

The thermodynamic properties of francium and a large number of francium compounds (halides, sulfides, cyanides, carbonates, sulfates, etc.) were investigated in their solid and gaseous states and in aqueous solution, at their standard states.

Enthalpy, entropy, heat of formation and sublimation, thermodynamic potential, lattice, and bond energy values were calculated by using the various mathematical relationships and methods of both Soviet and foreign scientists.

24. Thermodynamic Properties of Astatine and Polonium and Their Compounds

"Thermodynamic Properties of Some Astatine and Polonium Compounds," by G. A. Krestov; Leningrad, Radiokhimiya, Vol 4, No 6, 1962, pp 690-696

The thermodynamic properties of astatine, polonium, and other elements were investigated with the use of various methods of other authors, based primarily on ionic radii calculations, for calculating the desired values. Ionic radii were determined by using those elements (Kr, Xe, and Rn) which have isoelectronic ions for obtaining constants used to calculate the radii of other ions in both the crystal and gaseous states. From the calculated values of ionic radii, the interionic distances in gas molecules of astatinides and polonides of alkali and alkaline-earth metals and in molecules of the halogenides and chalcogenides of francium and radium were determined. The values of interionic radii were then used to calculate energy of the crystal lattice, ΔH , ΔG , and ΔZ , for the above compounds in their solid, aqueous, and gaseous states at standard conditions.

25. Electrolytic Deposition of Americium and Curium

"The Electrolytic Deposition of Americium and Curium on a Platinum Cathode From Aqueous Solution," by A. G. Samartseva; Leningrad, Radiokhimiya, Vol 4, No 6, 1962, pp 696-700

According to the author, americium and curium in aqueous solution are found in a stable, trivalent state and at these conditions display chemical properties analogous to rare-earth elements in that they are

C-O-N-F-I-D-E-N-T-I-A-L

not able or should not be able to be electrolytically deposited from aqueous solution owing to their strong tendency to hydrolyze. For this reason, a study was conducted to determine those conditions at which americium and curium could be electrolytically deposited with hydrolyzing.

The usual variables of electrolysis (electrolyte, electrolysis time, current density, and pH) were varied and data for testing conditions recorded.

Of the different electrolytes tested (H_2SO_4 , HCl , $HClO_4$, HNO_3 , and $H_2C_2O_4$), nitric acid gave the best results. Optimum conditions for depositing the two investigated elements were: americium -- pH=3.4-3.5; current density, 400-500 ma/cm²; time, 3-5 minutes. Curium -- pH=2.7-2.8; current density, 400-500 ma/cm²; time 20-30 minutes. Under these conditions, americium and curium can be quantitatively analyzed, deposited on a cathode in the presence of each other and possibly in the presence of other radioactive elements, and can possibly be applied in fine layers on targets.

26. Isolation and Deposition of Hafnium Without a Carrier

"Radiochemical Isolation of Hafnium Without a Carrier,"
by N. G. Zaytseva and Chzhou Mo-Lun; Leningrad, Radiok-
himiya, Vol 4, No 6, 1962, pp 738-739

A method for the radiochemical isolation of radioactive isotopes of hafnium without a carrier from the fission products of tantalum was developed. This method makes it possible to isolate several rare-earth elements simultaneously with hafnium and to later chromatographically separate them.

Also developed was a method of electrolytically depositing hafnium on a platinum target to be used as a source of beta rays for spectroscopic measurements.

27. Nobel Cases Found to React

"Dethroned 'Nobility'"; Moscow, Nedelya, 25 Nov-1 Dec 62,
p 5

A mixture containing one part xenon and five parts fluorine was heated at 400° for an hour and then quickly cooled. The compound xenon tetrafluoride was formed. This compound is relatively stable, withstands heating to 400° C, and reacts with water, although not as vigorously as most fluorine compounds. Radon was also found to react with fluorine.

Miscellaneous

28. Bureaucratic Indifference Keeps Respirator "Lepestok" From Large-Scale Production

"Procrastinations of Ivan Pavlovich," by A. Dokuchayev;
Moscow, Trud, 7 Feb 63, p 2

The article discusses the respirator "ShB-1" or "Lepestok" which was designed 8 years ago. The Academy of Sciences USSR has declared it to be effective in preventing silicosis in, for example, the lead mining and cement industries. Despite the declared usefulness of this respirator, it is not being widely produced. It is assigned only third priority importance in the division of light industry of the Gosplan, RS^{SSR}. Ivan Pavlovich Sadichev, chief engineer of the board of the State Committee on Chemistry of the Gosplan, USSR, who would be responsible for the full-scale production of this respirator, wants the device improved before it is produced. Improvements of the "Lepestok" design, "U-1," "U-2," and "F-62," have been developed but are also not yet being produced. The author of the article questions the value of waiting for further improvements on a device that has already been proved effective.

29. Structure of Heliomycin Proposed

"Concerning the Structure of the Antibiotic Heliomycin," by A. N. Grinev, A. S. Mezentshev, and D. V. Sibiryakova, Institute for the Search for New Antibiotics, Academy of Medical Sciences USSR; Zhurnal Obshchey Khimii, Vol 33, No 1, Jan 63, pp 315

A structural formula for heliomycin as a derivative of tetraoxy-tetracenequinone is proposed on the basis of comparison of the ultraviolet absorption spectra of heliomycin with that of 1,4,6-trioxy-tetracene-5,12-quinone and by study of chemical properties.

30. Equations for Detonation Waves Presented

"Calculation of the Parameters for the Detonation Waves of Condensed Explosives," by V. N. Zubarev and G. S. Telegin; Moscow, Doklady Akademii Nauk SSSR, Vol 147, No 5, 11 Dec 62, pp 1122-1125

Previously published experimental data were used in the derivation of mathematical equations for the state of explosion products during detonation. The explosion products considered are those which are

C-O-N-F-I-D-E-N-T-I-A-L

normally associated with conventional explosives, i.e., water, carbon dioxide, nitrogen, carbon, and carbon monoxide. Parameters of detonation waves are also presented.

31. Spectrum of Particle Size Determined for Radioactive Dusts

"The Nature of the Spectrum of the Sizes of Particles of Radioactive Dust of Natural Origin," by K. P. Makhon'ko; Moscow, Izvestiya Akademii Nauk SSSR, Seriya Geofizika, No 1, 1963, pp 183-187

On the basis of generalization of the data of different authors, an attempt is made to construct a general picture of the spectrum of sizes of radioactive dust of natural origin. A possible explanation of the form of the spectral curve is given.

The spectrum of the size of such particles in the region of $r < 7 \cdot 10^{-6}$ cm is not constant and has a number of maximums. The distribution of the maximums of the spectral curve in the region of $r \sim 10^{-8} \div 10^{-6}$ is very stable and does not depend on the time and conditions of the observations. The position of the basic maximums is described by the formula: $r_n^{\text{max}} = r_0 \cdot 2^n$ ($n=0, 1, 2, \dots$).

Knowledge of this spectrum is necessary to determine the mechanics of the behavior of this dust in the atmosphere and for investigating the interaction of a radioactive aerosol with different substances.

32. New Methods for Preparation of High Purity Boron Trifluoride

"On the Preparation of Boron Trifluoride," by G. M. Panchenkov and A. V. Makarov; Moscow, Vestnik Moskovskogo Universiteta, No 1, Jan/Feb 63, pp 3-6

Procedures are presented on the preparation of boron trifluoride by two methods. The first method is said to be convenient for preparing rather large quantities containing about one % silicon tetrafluoride:



The second method is used to prepare small quantities of highly pure boron trifluoride containing less than 0.1% silicon tetrafluoride:



Other methods of preparation involve secondary formation of hydrogen fluoride which reacts with glassware to give silicon impurities.

33. Bactericidal Paint Additive Developed

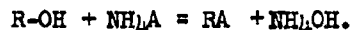
"Concerning the Utilization of Bactericidal Enamels,"
by M. N. Fedorov, Military-Medical Order of Lenin Academy
Imeni S. M. Kirov; Moscow, Gigiyena i Sanitariya, No 8,
Aug 62, pp 92-94

In 1956-1957, the All-Union Scientific-Research Institute of Medical Instrumentation and Equipment and the All-Union Scientific-Research Chemicopharmaceutical Institute developed and recommended for use a bactericidal enamel containing a formulation called "Diocide." This additive contains ethanol, mercuric chloride, sodium bromide, and cetyl piridine. According to test data, bactericidal coatings of the enamel containing 15% diocide are effective for up to 500 days on hospital and clinic furniture.

34. Desalination of Water With Hydrazine

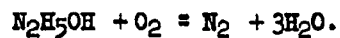
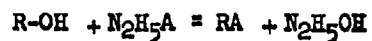
"Simultaneous Desalination and Deoxygenation of Water With Hydrazine Cations and OH-Anionites," by T. I. Vekhotko;
Leningrad, Zhurnal Prikladnoy Khimii, Vol 36, No 1, Jan 63,
pp 195-203

Desalination of natural waters or aqueous solutions may be carried out by distillation, H-, OH-ionization, or other means. In certain special cases, salts may be separated from water that is to be used for technical purposes with ammonium- and OH-ion exchangers. In this case, a considerable amount of ammonium hydroxide is introduced to the water to replace the ions that are caught up by cationites and anionites:



In the above equations, K represents cations, R represents the radical or ion exchange group carrier, and A represents the electrolyte anions found in solution. Since hydrazonium salts are similar to ammonium salts in their ion exchange properties, it seemed interesting to study the processes of hydrazine ionization and thereby determine the feasibility of using them for simultaneous desalination and deoxygenation of weakly mineralized waters to be used for technical purposes. Direct addition of hydrazine to water reduces dissolved oxygen at elevated temperatures. It was assumed that by charging cationite filters with hydrazonium ions and initiating hydrazine- and OH-ionization, it will be possible to absorb cations and anions from solution (conduct desalination) and at the same time obtain hydrazine hydrate in the solution which then reduces dissolved oxygen (at higher temperatures):

C-O-N-F-I-D-E-N-T-I-A-L



Experiments confirmed the possibility of conducting such processes (one mg of hydrazine is required for each mg of dissolved oxygen). It was also shown that the cationite and anionite filters can both be regenerated with a solution of the same reagent, such as hydrazine hydrate or hydrazine carbonate.

C-O-N-F-I-D-E-N-T-I-A-L

35. Soviets Develop Ceramic Burner for Complete Combustion of Gas

"In the World of the Interesting -- Heat Without Fire,"
by Vladimir Pospelov; Yerevan, Kommunist, 20 Jan 63, p 4

The laboratory of gas combustion of the Academy of Communal Economy developed a latticed ceramic burner which enable gas to be burned completely, leaving no residue.

As the article explains, "the gas-air mixture enters the burner at the usual speed. But, as it passes through small openings in the [red hot] ceramic disc, it burns quickly and completely."

These burners can be used in stoves and as heaters, for drying plaster, hardening enamel, etc.

36. New Polymer Used as Insulator, Improves Condensers

"In Brief About Various Things"; Moscow, Moskovskaya Pravda, 3 Feb 63, p 2

"Armenian chemists and physicists developed a new polymer with pronounced dielectric and piezoelectric properties. Specialists feel that use of this polymer to replace paper and mica as insulators will improve the quality of condensers and reduce their size. Plates of this compound can be used instead of quartz and other materials as ultrasonic generators and pressure recorders."

37. Luminophors Used To Detect Flaws in Machine Parts

"More Powerful Than a Microscope"; Moscow, Trud,
31 Jan 63, p 2

A new luminophorous liquid, "Shubekol," was developed by corresponding member of the Soviet Academy of Sciences N. Shuykin and the Georgian scientist and doctor of chemical sciences N. Bekauri. Machine parts are immersed in this liquid and then examined under ultraviolet light. Defects in the surface of the part retain the liquid and become apparent under the light.

The liquid is made from kerosene and is considerably cheaper than other luminophors, according to the article. It was tested and approved by the Central Heavy Industry Scientific-Research Institute and by several industries.

38. Central Automation Laboratory Builds Nuclear-Magnetic Spectrometer

"The Mail for One Laboratory"; Vechernaya Moskva, Moscow,
15 Feb 63, p 1

The Central Automation Laboratory developed a nuclear-magnetic spectrometer for use in studying the structures of various materials, including plastics, rubbers, bricks, and iron ore. The spectrometer is reliable and durable. One of these instruments was sent to Leningrad to the Institute of Silicate Chemistry of the Soviet Academy of Sciences.

39. Radiometric Method Used To Determine Tungsten Trioxide Content in Various Ores

"The Atom in Service of Chemistry," by L. Starchik and P. Solozhenkin, candidates in technical sciences; Dushanbe, Kommunist Tadzhikistana, 12 Feb 63, p 3

"Workers at the Institute of Mining imeni A. A. Skochinskiy and the Institute of Chemistry of the Tadzhikistan Academy of Sciences, under the direction of corresponding member of the Soviet Academy of Sciences I. N. Plaksin, developed and put into use the radiometric method of determining the tungsten trioxide content in various concentrates.

"One dry assay by the radiometric method requires only 10 minutes, compared to the 6 hours required by a chemical analysis.

"This method is used for crude and commercial concentrates having a wide range of tungsten trioxide content.

"Comparison of analysis results from the radiometric method with those from chemical analysis gave satisfactory results.

"Use of this new method allows a 50% reduction in the number of chemical analyses and eliminates "shift" chemical analyses of crude and commercial concentrates."

40. Glass Institute Makes Superfine Glass Fiber

"A Kilometer of Fiber From Peas"; Vilnius, Sovetskaya Litva, 15 Feb 63, p 4

The Glass Fiber Scientific-Research Institute developed a method for making superfine glass fiber. Pea-sized glass balls are heated in an electric furnace to produce about a kilometer of this fiber, which is 100 times finer than human hair. A cubic meter of this fiber weighs 5 kilograms. The fiber has many technological uses and will be used to make superfine filter for use in medicine.

C-O-N-F-I-D-E-N-T-I-A-L

41. Soviet Trade Exhibit Honors Tashkent Scientists for New Tartaric and Citric Acid Technologies

"Citric Acid From Cotton Plant Leaves," by V. Lapina;
Tashkent, Pravda Vostoka, 1 Feb 63, p 4

Scientists of the Tashkent Polytechnic Institute were recently awarded silver medals by the committee of the Exhibition of Achievements in the Soviet National Economy for developing equipment for continuous production of tartaric acid from by-products of the wine industry by using ion-exchange resins.

Another group of scientists from this institute was recently honored by the exhibition for its new method for extracting citric acid from the leaves of cotton plants. This process is twice as efficient as the old process developed by Uzbek Academician A. S. Sadykov and produces high-quality acid.

Conferences

42. 34th International Congress of Industrial Chemistry

"International Congress on Industrial Chemistry Will Be Held in Belgrade Under the Sponsorship of President Tito"; Belgrade, Dorba, 2 Feb 63, p 4

The 34th International Congress of Industrial Chemistry will be held in Belgrade on 22-29 September 1963 under the sponsorship of President Tito. In addition to approximately 800 chemists from Yugoslavia, more than 1,400 chemistry experts from 47 countries have indicated that they will attend. Many of these are academicians, university professors, directors of scientific-research institutes, etc. Nobel Prize winners in chemistry Prof Lavoslav Ruzicka, Prof Nikolai Nikolayevich Semyenov, and Prof Karl Chigler [phonetic], as well as such well-known authorities in chemistry as Professor Koracz from Budapest and Professor Tiszovski from Wroclaw, are expected to attend.

The Belgrade congress will devote considerable attention to achievements in the field of production of synthetics from petroleum and lignite. Papers and reports are also expected to deal with achievements in the food-processing industry; a special symposium will deal with spectroscopy.

During the congress sessions, an International Fair of the Chemical Industry will be held in Belgrade from 27 September to 5 October.

II. METALLURGY

Corrosion

43. Corrosion Research in Latvian SSR

"Protection From Corrosion"; Moscow, Nedelya, No 1,
29 Dec 62-6 Jan 63, p 7

"A research project devoted to the problem of protecting metal from corrosion was completed in 1962 at the Institute of Chemistry Academy of Sciences Latvian SSR. Here, under the leadership of Academician L. K. Lepin', the principles of corrosion processes in water and aqueous solutions at temperatures from 0 to 100°C were developed. These principles make it possible to pre-determine the loss of metal during any time interval. A large number of graphs were constructed on the basis of which important relationships were established."

44. Corrosion Studies of Stainless Steels

"Corrosion Resistance of Stainless Steels to the Corrosive Media of Hydrolysis Production," by I. M. Grinshteyn, Ye. A. Adamovich, and Ye. V. Antonova; Moscow, Gidroliznaya i Lesokhimicheskaya Promyshlennost', No 8, 1962, pp 22-23

Many new grades of stainless steel have been developed in the past years to reduce the consumption of and to find a substitute for grade 1Kh18N9T steel. Special attention has been given to the investigation of substitute steel which will withstand the highly corrosive media found in furfural and yeast production.

The following grades of stainless steel containing little or no nickel were subjected to corrosion tests: non-nickel steels -- Kh17T, Kh17M2T, and Kh25T (EI-439); low-nickel steels -- OKh21N6M2T (EP-54), OKh21N5T (EP-53), 1Kh21N5T (EI-8N), 1Kh18N2AG5 (EP-26), Kh28AN (EI-657), and Kh14G14N3T (EI-711). Properties and composition of these steels were published in Stali s Poniizhennym Soderzhaniyem Nikelya (Spravochnik) (Steels With Low Nickel Content [Handbook]), Metallurgizdat, 1961. Carbon steel St. 3, M-3 copper, and 1K-80-3 and Br AZh-9-4 copper alloys were also subjected to corrosion tests to obtain some comparative data.

Laboratory and operational tests were made at the Scientific-Research Institute of Hydrolysis and Alcohol Production, the Krasnodarsk Hydrolysis Plant, and the Leningrad Hydrolysis Plant. The different grades of steels and alloys were subjected to the action of various corrosive media at different temperatures, pressure, and period of time.

In most instances, the tested steels could not compare to grade 1Kh18N9T for corrosion resistance; however, two steels -- Kh25T and Kh14G14N3T -- were found to be suitable as substitutes for 1Kh18N9T in yeast production. The general conclusion, based on the present tests, was that the other grades of stainless steel, although not as good as 1Kh18N9T, can be used until a less costly and more corrosion-resistant alloy or low-alloy steel is found.

45. Corrosion Studies of Titanium and Titanium-Alloy Welds

"Uses of Titanium for Industrial Chemical Equipment,"
by G. I. Shvarts, Candidate of Technical Sciences, and
Engr L. S. Makarova; Moscow, Khimicheskoye Mashino-
stroeniye, No 6, Nov/Dec 62, pp 18-23

At the present time, the production of technically pure titanium, grade VT-1, and titanium alloys with Al Mn, with Al, Cr, and Mo, with Al and Sn, and with Al and Mn is being thoroughly studied in conjunction with their use as materials for the manufacture of chemical equipment. Of these alloys, VT-1 and OT-4 with Al and Mn were found to be best suited due to their physical and corrosion properties.

This report presents the data obtained from investigations on the corrosion rates of titanium-alloy and acid-resistant-steel welds in various corrosive media encountered in different metallurgical processes. Submerged-arc and argon-arc welds of VT-1 and OT-4 were subjected to corrosion tests and compared to the corrosion rate of whole specimens. Steels OKh23N28M3D3T, Kh18N12M2T, and Kh18N9T were all welded by the electric-arc method and tested. For example, the welded metals were exposed to a sulphuric acid solution with a pH=2 containing 67.5 g/l H_2SO_4 , 0.32 g/l cobalt, 0.65 g/l copper, 0.45 g/l iron, 4 g/l boric acid, 40 g/l chlorine ions, and 0.57 g/l H_2SO_4 at a temperature of 60-65°C for a period of 1,040 hours (hydrometallurgical production of nickel).

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Results of the corrosion tests showed that titanium VT-1 and its weldments were unsuitable for the production of sulfuric, hydrofluoric, and fluosilic acids even at low concentrations. Titanium welds should not be used in the presence of boiling solutions of oxalic or citric acid, nor exposed to fuming nitric acid, dry chlorine, liquid bromine, or, in certain instances, to oxygen, as there is the danger of combustion.

At the present time, chemical machine building plants are producing reactors, separators, filtering units, and heat exchangers from titanium. It is calimed that increase of the output of titanium-alloy equipment with guaranteed mechanical properties will require the development of technology for casting titanium and for lining chemical equipment with titanium-alloy sheet.

Crystal Growing46. Growing Thin-Film Germanium Crystals

"Experiments on the Growing of Germanium Crystals in Thin Layers," by G. A. Kurov, V. D. Vasil'yev, and M. G. Kosaganova, Institute of Crystallography, Academy of Sciences USSR; Moscow, Kristallografiya, Vol 7, No 5, Sep/Oct 62, pp 773-779

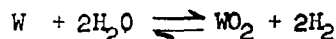
A study was conducted on the growing of germanium crystals and the formation of layers of germanium 1-20 microns thick. The method used consisted of vacuum vaporization of the germanium at 970°C with subsequent condensation at 800°C on the condensing plate. Condensing plates of quartz, graphite, steel, and tantalum were used to determine which material is best suited for this process.

The effect of temperature and the material of the condensing plate were studied with respect to the size and shape of the germanium crystals formed. The temperature range was determined for the selective recrystallization of germanium in fine layers.

47. Tungsten Crystals Grown by Reduction of WO₂ Vapors and Condensation

"Growing Tungsten Crystals From Vapors," by O. V. Mitrofanov, Tarangog Radiotechnical Institute; Moscow, Kristallografiya, Vol 7, No 5, Sep-Oct 62, pp 780-783

The process involved in the growing of tungsten crystals in this research was based on the following chemical reaction;



where a small tungsten rod, which also served as the condensing plate, was resistance heated in the presence of water vapor. By maintaining a temperature gradient throughout the length of the rod, tungsten was oxidized at the high temperature end, the tungsten oxide vaporized, and pure tungsten condensed on the colder end of the rod. Introduction of hydrogen into the system expedited the process as it shifted the equilibrium to the left by reducing the tungsten oxide.

The size and shape of the resulting crystals were determined to be a function of the temperature gradient of the rod and the concentration of vapors along the length of the rod. Crystals were observed in the form of rhombic dodecahedrons with an average size of 0.1 mm, in the form of twin crystals, and as crystals growing in concentric circles. The difference between the crystallographic orientation of the crystals of the tungsten plate and the grown crystals was not more than 0.1°.

Crystallography48. Study of Vacancies and Their Effect on the Heat-Resistance of Alloys

"Annihilation of Vacancies in the Process of Creep As a Factor for Increasing Heat Resistance," by V. N. Gulyayev; Moscow, Izvestiya Akademii Nauk SSSR, Otdeleniye Tekhnicheskikh Nauk, Metallurgiya i Toplivo, No 6, Nov/Dec 62, pp 103-106

The annihilation of vacancies in metals during creep by forced combination of positive and negative imperfections as a means of increasing the heat-resistance of steels and alloys is discussed. The effects which alloying components exhibit on the movement of dislocations and the absorption of vacancies in submicroscopic regions forming substitutional solid solutions are presented, as well as mathematical relationships for determining the number of vacancies and time-to-fracture in long-time tensile tests.

A number of austenitic steels were tested to compare their long-time tensile strengths and heat-resistance, which they normally exhibit, to the same properties after small quantities of small-atom elements had been added. Steels 1Kh18N9T, EI-257, -257T, -694, -695, and -724; and OKh18N5G10A were subjected to a 10,000-hour test at 650°C. A table of the tensile strengths is given.

Steel EI695 without boron had a long-time tensile strength of 10 kg/mm² after 100,000 hours. Addition of 0.005% B increased this value to 11.5 kg/mm², and an addition of 0.025% B increased its strength to 19 kg/mm².

49. Development of Stacking Faults in Ni-Cu and Ni-Co Alloys

"Stacking Faults in Solid Solutions of Nickel," by N. I. Noskova and V. A. Pavlov, Institute of Metal Physics, Academy of Sciences USSR; Sverdlovsk, Fizika Metallov i Metallovedeniye, Vol 14, No 6, Dec 62, pp 899-903

The formation of stacking faults in Ni-Cu (40% Cu) and Ni-Co (40% Co) alloys by plastic deformation was studied by X-ray diffraction analysis. It was noted that alloying reduces the stacking-fault energy by an amount depending on the alloy content.

Changes in the electrical resistance, amounting to 6% for the Ni-Cu alloy and 8% for the Ni-Co alloy, were explained by the development of a large number of stacking faults and the interaction of these faults with the alloying components forming micro-heterogeneous solid solutions.

50. Dislocations and Their Effect on Fatigue Strength

"Investigation of the Role of Grain Boundaries in the Development of the Fatigue," by V. S. Ivanova; Moscow, Izvestiya Akademii Nauk SSSR, Otdeleniye Tekhnicheskikh Nauk, Metallurgiya i Toplivo, No 6, Nov/Dec 62, pp 90-97

Studies of fatigue rupture showed that submicroscopic cracks initially develop within the grains of the metal as a result of dislocation accumulation. These cracks are not harmful until the dislocation density reaches a critical value ($10^{14}/\text{cm}^2$ for Cu, Al, and Fe) which requires considerable time, depending on the magnitude of the applied stress. Once the microcracks have propagated to the grain boundaries by dislocation multiplication, they can be transmitted to neighboring grains, and the development of macrocracks is initiated. Here the grain-boundary energy becomes an important factor, and the magnitude of this energy is a function of lattice structure and bond strength of the crystals.

51. Dislocations in Chromium

"Observation of Dislocations in Cast and Deformed Chromium," by D. A. Prokoshkin, M. P. Matveyeva, and Yu. M. Platov; Moscow, Izvestiya Akademii Nauk SSSR, Otdeleniye Tekhnicheskikh Nauk Metallurgiya i Toplivo, No 6, Nov/Dec 62, pp 107-111

Chromium specimens obtained by vacuum condensation and vacuum casting were vacuum annealed at $1,300^\circ\text{C}$ and examined microscopically. Cast specimens (thermally etched) were found to have a rectangular, mosaic structure with the rectangles outlined by dislocations. Other specimens, slightly deformed and electrolytically etched, had a microstructure composed of triangular-shaped pits in some grains and rectangular-shaped pits in other grains.

Fracture specimens of chromium were investigated, and it was noted that fracture occurs with the generation, combination, and multiplication of dislocations in the form of microcracks under the action of an external stress.

The authors believe that microstructural investigations using the described methods of etching can result in the establishment of principles for explaining the nature of strengthening, plastic deformation, and fracture of chromium.

52. Domain Orientation in Barium Titanate Crystals

"On the problem Concerning the Effect of Mechanical Loading on the Orientation of Domains in Single Crystals of Barium Titanate," by S. V. Bogdanov, Physical Institute imeni P. N. Lebedev; Moscow, Kristallografiya, Vol. 7, No 5, Sep/Oct 62, pp 755-760

Investigations were made of the domain structure of single crystals of BaTiO_3 under the influence of an external mechanical stress and the piezo-effect on the orientation of the domains.

Variables in the tests included loading (stress) time, stress magnitude, and temperature for which the phenomena of reversible and irreversible orientation of the domains were studied.

The conclusion was made that the process of domain-structural change is associated with the change in the direction of the polarizing axes of the domain (by 90°). From results of testing, the following points were noted:

1. Domain reorientation occurs only when the mechanical stress exceeds the critical value for the particular crystal;
2. The reorientation is nonspontaneous -- a finite period of time is required which is a function of the stress and temperature;
3. The process can be reversible or irreversible depending on the stress and time of application;
4. Reversion to the original domain structure (in a reversible process) is not spontaneous and requires the same conditions as in "2."

53. Studies of Dislocation Structure

"Dislocation Structure of Some Deformed Metals and Alloys," by L. N. Guseva and A. A. Babareko; Moscow, Izvestiya Akademii Nauk SSSR, Otdeleniye Tekhnicheskikh Nauk -- Metallurgiya i Toplivo, No 6, Nov/Dec 62, pp 98-102

The dislocation density and distribution in copper, chromium, and some copper alloys (Cu-Zn, -Al, -Sn, -Sb, and -Ni) were calculated after deformation. Lattice parameters and substructures of the crystals were determined from X-ray diffraction pattern studies. Mathematical expressions are given for approximating the dislocation density.

According to the authors, this data can be used to explain the mechanisms of plastic flow and metal fracture and also can serve as the criterion for the plastic properties of metals in the microscopic state.

Forming and Treatment54. Anisotropic Properties of Avial

"Press-Effect in Products Made From Avial," by S. S. Gorelik, Candidate of Technical Science, and Engrs Yu. M. Vaynblat and E. A. Malysheva, Moscow Institute of Steel and Alloys; Moscow, Metallovedeniye i Termicheskaya Obrabotka Metalloy, No 12, Dec 62, pp 48-49

The effects resulting from the hot-pressing of the aluminum alloy Avial were studied. Mechanical tests showed that immediately after pressing there is no evidence of property changes (anisotropy), whereas after heat treatment the mechanical properties of the pressed parts are improved and there is a noted degree of anisotropy.

It was believed that the stability of the alloy depends on the manner of polygonization where dislocation climb and polygonization are facilitated by the simultaneous action of stress and temperature and the polygonization is uniform. If polygonization is uniform throughout a large volume, subsequent recrystallization is hindered and a stable structure can be obtained only by nonuniform polygonization which results in an alloy with anisotropic properties.

55. Heat Treatment of Titanium-Chromium Alloys

"The Effect of Heat Treatment on the Structure and Hardness of a Ti 4%Cr Alloy," by N. M. Pul'tsin and V. B. Pokrovskaya; Sverdlovsk, Fizika Metallov i Metallovedeniye, Vol 14, No 6, Dec 62, pp 843-847

A titanium alloy containing 4.05% Cr, 0.57%, 0.24% Mn, and 0.17% Ni was produced by a powder metallurgy method for the purpose of studying the effect of heat treatment on the structure and hardness this alloy. Mechanical properties of the alloy prior to heat treatment were:

Tensile Strength (kg/mm ²)	101
Yield Strength (kg/mm ²)	98
Elastic Limit (kg/mm ²)	94
Elongation (%)	21
Reduction in Area (%)	22

Specimens 100 mm long and 8 mm in diameter were heat treated at various temperatures in the 700-1,000°C interval for 40 minutes and water quenched. Vicker's hardness (30 kg load) measurements were made and microphotographs taken. Hardness data are given below.

C-O-N-F-I-D-E-N-T-I-A-L

Quench Temperature (°C)	700	800	850	875	950	1000
Hardness (kg/mm ²)	349	465	583	580	550	541

The decrease in hardness above 850°C was a result of grain growth of the beta phase and dissolving of the excess alpha solid solution. This conclusion was evidence by the microphotographs.

Additional tests were made by annealing specimens quenched from 850°C for extended periods of time (25, 50, 100, 200, 300, and 400 hours) at 650°C. Results of this test showed that from t_0 to $t = 2.5$ hours, the hardness dropped sharply from 489 to 350 kg/mm². After 2.5 hours, the hardness remains fairly constant. The distinct change in hardness was, in this case, the result of the formation of a coarse-grain solid solution and dispersion of TiCr₂ inclusions.

According to the authors, the eutectoid of Ti-Cr alloys is difficult to study because the microstructure is not easily revealed. However, they were able to accomplish this by heat treating specimens at 650°C for 100 hours and etching electrolytically or chemically with a fluorine-nitric acid solution.

56. Investigations of Cold-Worked Niobium

"Investigation of the Cold-Worked Texture of Rolled Niobium," by D. I. Layner, V. Ya. Solov'yev, Ye. I. Krupnikova-Perlina, nad Ye. V. Kachur; Moscow, Tsvetnyye Metally, No 11, Nov 62, pp 80-85

Investigations were made of the texture of niobium produced by various methods and cold-worked as much as 99,999% in order to study the orientation of grains and the effect of impurities on the cold-worked texture.

Samples of arc-melted, cast, and forged niobium were subjected to varying degrees of heat treatment and cold-working in the form of sheet, rod, pipe, and complex shapes. Examination of the rolled niobium samples was made with the use of stereo-net projections and the following conclusions drawn:

1. The technological process of cold-working niobium had no effect on the resultant cold-structure since an increase in the degree of cold-working in the later stages of deformation was accompanied by an improvement of the cold-worked structure.

C-O-N-F-I-D-E-N-T-I-A-L

2. Impurity content (O_2 , N_2 , and C) within the required limits and the melting and cold-working processes were found to have no effect on the texture of samples cold-worked to 95% or more.

3. The principal axes of the cold-worked texture in rolled niobium were found to be $(112) \sqrt{110} + (100) \sqrt{110}$.

57. Investigation of High-Temperature Castings for Turbine Parts

"Cast Heat-Resistant Alloys," by L. B. Getsov and N. P. Zhukov;
Moscow, Liteynoye Proizvodstvo, No 11, Nov 62, pp 9-11

It is claimed that the need for longer-life parts, especially the stator blades of gas turbines, necessitated an investigation of the casting and the properties of steels Kh11LB (12Kh12VMF) and EI-787L and alloys EI-765L and EI-607L. Foundry technology, physical properties, and heat treatment of the steels and alloys were studied and compiled data were compared to the properties and treatment of their forged counterparts. In most instances, the cast specimens of the different materials possessed a lower heat resistance than the forged specimens but, at the same time, had a greater long-time tensile-strength. Chemical composition, heat-treating specifications, physical properties, and long-time tensile data are given in text.

58. Plastic Deformation of High-Purity Rhenium

"Mechanism of Plastic Deformation of Rhenium With Varying Purity," by Ye. M. Savitskiy and G. Ye. Chuprikov; Moscow, Izvestiya Akademii Nauk SSR, Otdeleniye Tekhnicheskikh Nauk, Metallurgiya i Toplivo, No 6, Nov Dec, pp 167-170

Two single crystals of rhenium were zone-refined to different degrees to obtain a difference in purity for comparative evaluation. The content of O₂, H₂, and N in sample A was 0.002, 0.0005, and 0.000%, respectively, and for sample B, 0.006, 0.0008, and 0.0007% respectively.

The crystals were strained 2% at room temperature, and slip traces on the crystal surface were investigated. Results of the investigation showed that the slip occurs initially on plane (1010). In all the remaining conditions, increase of the oxygen content as an interstitial impurity, up to 0.006%, causes two systems of slip. One is along plane (1010), and the other, along the basal plan (0001) in the (1120) direction. A similar effect of oxygen on the mechanism of deformation has been observed for alpha-titanium when stressed at room temperature.

59. Vacuum Rolling of the Chemically Active Refractory Metals

"Vacuum Rolling of Chemically Active Metals," by V. Ye. Ivanov, S. F. Kovtun, N. D. Tarasov, and R. A. Ul'yanov; Moscow, Tsvetnyye Metally, No 11, Nov 62, pp 85-88

A small-scale vacuum rolling stand and the processes involved in the vacuum rolling of chemically active metals titanium, tantalum, molybdenum, zirconium, niobium, and tungsten and their alloys produced by power metallurgy methods described.

Vacuum rolling has been found to be quite satisfactory in producing high quality, noncontaminated, refractory-metal alloys, which was not possible in some cases by conventional rolling methods. Specifically mentioned were alloys of niobium and tantalum with molybdenum, rhenium, tungsten, iridium, palladium, chromium, and lanthanum, even though some of these alloys had a Brinell hardness of 350 kg/mm² or higher prior to rolling. Also mentioned were the facts that rollability is improved by reducing the amount of insoluble elements such as boron and silicon and by adding 0.4-0.5% lanthanum.

Shrinkage factors, rolling temperatures, alloy content, etc. are discussed for the various alloys. Development of a multistand vacuum rolling mill for increasing the production of rolled products

is mentioned. This mill, in spite of the large number of vacuum seals, is maintained at a vacuum of 10^{-2} mm Hg by a diffusion pump which has an evacuating capacity of 20,000 liters/sec.

New Equipment, Processes, and Products

60. New Aluminum- and Zinc-Based Alloys and Machine Tool Parts

"New Bearing Alloys," by N. P. Nikolaychik; Moscow, Liteynoye Proizvodstvo, No 11, Nov 62, pp 37-38

The search for more economical alloys has led to investigation of aluminum- and zinc-based alloys, especially the new Al-Cu-Pb alloy, Al'kusip (Ye, F. Merkulov, Author's Certificate No 410570, 1950).

Research on the optimum composition, properties, and production technology of Al'kusip was conducted at the Novocherkassk Electric Locomotive Building Plant where three grades of this new alloy were recommended for industrial use: AMSK-3 for replacing brasses. Lathe and grinding machine mparts were cast from these alloys and found to be better operationally than tin-bronze parts.

A zinc alloy, TsAML2-2 (containing Al, Cu, and Mg), was also developed at the plant which will be used not only in the production of sleeves and inserts but also as a substitute material for worm gears. Chemical composition and physical data for the alloys described are given in the text.

61. New High-Strength Glass for Production of Glass Pipe

"Dependable as Metal," by Lenina Kaybysheva; Kiev, Rabochaya Gazeta, 25 Jan 63, p 4

A new, High-strength, nonborate glass has been developed at the Institute of Glass of the All-Russian Sovnarkhoz by Soviet scientists Iosif Shapiro, Isay Tykachinskiy, and Yelena Frolova.

This new glass, designated as grade 13-V, is resistant to attack by the corrosive action of acids, alkalis, and organic solvents. It also has high dielectric properties and a low coefficient of thermal expansion.

Testing of pipe made from 13-V glass was conducted at the Bucha Glass Plant, while the Gomel' Glass Plant organized the production of a wide assortment of shaped parts. Glass pipe is being produced at the Bucha, Gomel', and Konstantinovka glass plants.

It has been estimated that 1,200 enterprises in the USSR have been supplied with more than 1.6 million meters of glass pipe which will replace more than 18,500 tons of nonferrous metals and alloy steels.

62. Newly Designed Plasma-Arc Cutting Unit Put Into Production

"Plasma Cuts Metal"; Moscow, Nedelya, No 1, 29 Dec 62 - 6 Jan 63, p 6

An automatic unit for plasma cutting of metal has been designed at the Tbilisi Affiliate of the All-Union Scientific Research Institute of Electric Welding Equipment and put into series production. This unit is capable of cutting through an ingot of steel 50 mm thick in a matter of a few seconds. "The stream of ions which is generated in the electric field and compressed by flows of argon gas and air, impinges upon the metal, heating it to 15,000° C."

63. New Method for Extraction of Alumina From Silicate Rocks

"Metal From Clay"; Moscow, Krasnaya Zvezda, 22 Sep 62, p 6

A plant near Irkutsk has started the production of alumina from kaolinite, shale, and other silicate rocks using a new electrothermal process developed by a group of Leningrad scientists. It is claimed that with the new process, the raw ore needs no pretreatments prior to the electrothermal process, thereby greatly reducing the consumption of power at the plant.

64. Testing New Pulsed-Jet Mining Unit Completed

"A Gun of Peace"; Moscow, Nedelya, No 1, 29 Dec 62 - 6 Jan 63, pp 6-7

Industrial testing has been completed on a new mining unit which cuts rock and ore by intermittent discharges of a jet of water at high velocity. This unit was developed by the Institute of Hydrodynamics of the Siberian Department, Academy of Sciences USSR, the Yasinovataya Machine Building Plant, and Dongiprouglemash (Donets Affiliate of the State Planning, Design, and Experimental Institute of Coal Machine Building). The unit, called "the gun," discharges water in bursts under a pressure of 7,000-8,000 atmospheres at the rate of more than one kilometer per second.

Patents

65. Recent Soviet Patents in the Field of Metallurgy

"Authorship Certificates"; Byulleten' Izobreteniy, No 22,
Nov 62

1. Class B 21c; 7c, 10. No 161664. V. N. Grach, "Device for Stamp-
ing Items from Sheet Blanks." [Explosive forming]

2. Class 12c, 2. No 151673. A. B. Lyskovich, V. I. Vaydanich,
B. A. Belikovich, I. M. Spitkovskiy, and L. N. Kulik, "Shaft Furnace for
Growing Crystals by the Kiropulos Method."

3. Class 18c, 18g. No 151690. I. A. Gindin, Ya. D. Starodubov,
and V. M. Azhazha, "Method of Increasing the Service Life of Metals and
Alloys Under Creep Conditions at High Temperatures."

4. Class 40b, 6. No 151829. B. S. Tikhonov and S. I. Chizhov,
"Copper-Base Alloy." [3.5-4.0% Sn, 1.5-3% Fe]

5. Class 40b, 15. No 151830. A. S. Gladkov and Ye. I. Mityayeva,
"Zirconium-Base Alloy for Braze Joints With Glasses." [3 to 10% W, 0.8-
1.5% Ti]

6. Class 49e, 3. No 151930. B. N. Putimtsev, "Apparatus for
Obtaining Powders for Metals and Alloy."

"Authorship Certificates"; Byulleten' Izobreteniy, No 23,
Dec 62

1. Class 22h, 3. No 152044. R. I. Abramova, V. I. Nikitin, M. V.
Rogova, L. S. Markova, and L. V. Glukhova, "Method of Obtaining Heat-
Resistant Coating."

2. Class 402, 46₅₀. No 152063. V. Yu. Kramnik, E. S. Fal'kevich,
and S. P. Sadovnik, "Method of Determining of Quality of Sponge Titanium
by Measurement of Hardness."

3. Class 49b, 1. No 152160. V. I. Semeryuk, "Method of Preparing
Aluminum Items for Electrolytic Coatings."

Powder Metallurgy66. Physical Properties of Hafnium Carbide

"Some Physical Properties of Powder-Metal Samples of Hafnium Carbide," by V. N. Paderno; Moscow, Izvestiya Akademii Nauk SSSR, Otdeleniye Tekhnicheskikh Nauk - Metallurgiya i Toplivo, No 6, Nov-Dec 62, pp 176-178

Some of the physical properties of a powdered hafnium carbide containing 93.68% Hf, 6.3% combined carbon, and 0.02% free carbon, sintered at 3,000°C under a pressure of 180 kg/mm², were determined for the purpose of appraising their suitability in high-temperature engineering.

Among the properties studied which are included in a table along with the same properties for Ti, Zr, Hf, TiC, and ZrC, are resistivity, coefficient of thermal expansion, thermal emf, Hall's coefficient, absorption coefficients, Peltier number, and electron conductivity.

67. Production and Properties of Titanium Aluminides

"Production and Properties of Titanium Aluminides," by G. V. Samsonov and V. S. Sinel'nikova; Moscow, Tsvetnyye Metally, No 11, Nov 62, pp 92-95

Data on the physical, chemical, and electrical properties of two titanium aluminides, produced by powder metallurgy methods, are presented. The two aluminides, TiAl (37% Al) and TiAl₃ (54.3% Al), were produced by mixing the proper ratio of metal powders to obtain the desired compound, pressing under 2.6 tons/cm², and sintering at 400-1,350° C for 30 minutes. For comparison of properties and evaluation of procedure, a second method of producing these alloys was used which comprised melting aluminum (Grade A-00, 99.8% Al) with titanium iodide in an arc furnace with a nonconsumable ensure uniform density and composition. Table of properties for the aluminides produced by the two methods is given below:

	<u>TiAl</u>		<u>TiAl₃</u>	
	<u>I</u>	<u>II</u>	<u>I</u>	<u>II</u>
Microhardness (50 g)	615	280	465	502
Density (g/cm ³)	2.63-3.89	3.874	2.64-3.27	3.37
Conductivity (micro-ohm-cm)	54	48.5	17-22	16.5

C-O-N-F-I-D-E-N-T-I-A-L

	<u>TiAl</u>		<u>TiAl₃</u>	
	<u>I</u>	<u>II</u>	<u>I</u>	<u>II</u>
Thermal coefficient of conduction (deg ⁻¹)		1.49x10 ⁻³		4.78x10 ⁻³
Thermal e.m.f. (mv/deg)	-5.1	-5.5	+2.8	+4.5
Coefficient of thermal expansion (deg ⁻¹)		11.43x10 ⁻⁶ (20-1070°)		1.65x10 ⁻⁶ (20-870°)

Soldering Welding

68. Corrosion Protection of Soldered Aluminum Parts

"Chemical Nickel-Plating of Soldered Aluminum Parts," by S. A. Vishenkov, Candidate of Technical Science, and Engineers V. M. Gostenina, V. S. Yekatova, L. A. Faykina, and L. V. Filimonova; Moscow, Metallovedeniye i Termicheskaya Obrabotka Metallov, No 12, Dec 62, pp 33-36

A study was made of nickel-plating of aluminum items (used in radio engineering) prior to soldering in order to obtain corrosion-resistance data. From past experience with other methods of surface preparation for soldering it was found that abrasives, ultrasonics, etc. don't give reliable protection of the aluminum against the components of the low-melting solder.

Alloys AMg, AMts, and D-16 were nickel-plated, soldered, and subjected to extensive corrosion tests. The nickel coating, also containing a small amount of phosphorous, has an electronegating potential very close to that of the aluminum, thereby reducing the reaction of galvanic parts. Identical corrosion tests were made on soldered items which had been cleaned by abrasives prior to soldering.

Comparison of corrosion tests showed that the nickel-plated parts are quite resistant to corrosive attack. For example, specimens of the nickel-plated aluminum showed traces of corrosive attack after 3-4 months exposure in a moisture tank while specimens of the abrasion method corroded and broke within the first month of testing.

The nickel-plating procedure and conditions of testing for the soldered samples are described.

69. Development of New Semiconductorized Welding Rectifier

"Semiconductors Are Saving Copper"; Leningradskaya Pravda,
31 Jan 63, p 4

A new welding rectifier has been developed at the All-Union Scientific Research Institute of Electric Welding Equipment. This is the first Soviet semiconductorized power supply for arc welding. It permits six welders to work simultaneously at currents up to 300 amps.

This silicon-semiconductorized rectifier which uses aluminum windings instead of copper has been recommended for series production. It is claimed that in addition to the hundreds of tons of copper which will be saved, many thousands of kilowatt-hours of energy will be saved by its use.

70. Investigations on Stress-Corrosion Cracking of Steels

"Tendency of Steels Toward Stress-Corrosion Cracking in Various Media," by F. F. Azhugin and Yu. K. Pavlov, Korroziya i Zashchita Metallov (Corrosion and Protection of Metals), Moscow, Oborongiz, 1962, pp 112-117 (from Referativnyy Zhurnal -- Khimiya, No 24, Part I, 1962, Abstract No 24I321)

"In comparing the results of tests on the tendency of high-strength steels toward stress-corrosion cracking in a solution of 20% H_2SO_4 + NaCl (30 g/l) with results of tests simulating tropical conditions (salt-spray, fog chamber) and conditions in industrial areas, it was established that with an increase of the critical stress achieved by testing stressed samples in the above-mentioned solution, the time to the start of stress-corrosion cracking in a given media also increases. Steels of various types, having a critical-stress value greater than 50 kg/mm², were found to have very little tendency toward stress-corrosion cracking in the simulated industrial atmosphere."

71. Prevention of Sigma-Phase Embrittlement in Welding of EI-437 Steel

"Prevention of Embrittlement in Welded Seams of Type 25-20 Austenitic Steels," by B. I. Medovar and N. I. Pinchuk, Institute of Electric Welding imeni Paton, Academy of Sciences Ukrainian SSR; Kiev, Avtomaticheskaya Svarka, No 10, Oct 62, pp 46-49

An investigation of 25-20 type austenitic steel (EI-437) was made for the purpose of developing a new grade welding wire which would prevent embrittlement of the base metal and weld resulting from the gamma-sigma transformation in the 700-850°C interval.

Previous works have shown that formation of the sigma-phase can be greatly reduced by increasing the carbon and nitrogen content of the weld, as both elements are capable of stabilizing the gamma-solid solution and possess an affinity for chromium to form a carbonitride phase thereby reducing the possibility of FeCr nucleation.

Specifications for a new welding wire with increased carbon and lower chromium content were standardized according to ChTMU/TsNIICHM-275-60.. This wire, EP-155, type 20Kh20N15G7AT [see note at end of abstract], had the following chemical composition:

C-O-N-F-I-D-E-N-T-I-A-L

Carbon	0.18 -- 0.25%
Manganese	6.0 -- 8.0
Sulfur, Max	0.02
Phosphorus, Max	0.03
Silicon, Max	0.35
Chromium	19.0 -- 22.0
Nickel	14.0 -- 16.0
Titanium	0.6 -- 1.0
Nitrogen	0.25 -- 0.45

Double-welded butt joints of Kh23N18 (EI-437) sheet steel and EP-155 wire were welded under a submerged arc using ANF-5 flux and welded under inert-gas shields of argon and carbon dioxide, heat treated at 800°C for periods of 4, 100, 1,000, 3,000, and 5,000 hours, and subjected to impact tests.

Results of impact tests were compared with earlier tests of 25-20 type steel welded with Kh25N20 and 2Kh25N16G7 wire where it was found that joints welded with EP-155 wire under the submerged arc and in the argon shield had the highest impact strengths. Of the two, the submerged-arc welds had the better impact strength after all the periods of heat treating but a lower impact strength in the as-welded condition.

Metallographs of the fractured welds indicated only that there is less sigma phase present in joints welded with EP-155 wire and consequently less embrittlement.

[Note: Four fiddlerent grade designations, probably due to typographical errors, were given in the text for EP-155 welding wire: Kh22N15G7AT, 2Kh25N16G7AT, 20Kh20N15G7AT, and 20Kh22N15G7AT. Grade 20Kh20N15G7AT, reported in this abstract, is assumed to be correct on the basis of the given chemical composition.)

Surface Treatment and Reactions

72. Study of the Altered Surface Layer of Titanium Alloys

"Concerning Some Structural and Concentration Features of the Altered Layer of Titanium Alloys," by N. M. Pul'tsin, Air Force Engineering Academy; Ordzhonikidze, Izvestiya Vysshikh Uchebnykh Zavedeniy -- Tsvetnaya Metallurgiya, No 5, 1962, pp 137-140

An investigation was made on the surface layer of titanium alloy specimens which become contaminated (primarily with O_2 and N_2 and sometimes with the mold materials during casting.

Titanium alloys VT2 and VT5-1 were examined as to impurity content, degree of penetration, and the adverse effects which these factors have on the composition, hardness, and brittleness of the surface layer.

The effect which chromium has in reducing gaseous corrosion (oxidation, nitriding, etc.) of binary titanium alloys was also studied. It was found that increased chromium content reduces gaseous corrosion.

No conclusions were drawn for eliminating the altered layer, although it was deemed to be detrimental to the strength and toughness of the alloy.

73. Boriding Steels in Boron Anhydride

"Electrolytic Boriding in Boron Anhydride," by Engrs N. N. Nogtev and Yu. M. Ragozin, Perm Polytechnic Institute; Moscow, Metallovedeniye i Termicheskaya Obrabotka Metallov, No 12, Dec 62, pp 49-50

Boriding of steels with boron anhydride (B_2O_3) was investigated to determine if a faster rate could be achieved since known boriding methods are quite slow.

Steels U8, 10, and 50 were subjected to boriding in molten B_2O_3 at $950^\circ C$ at a current density of 0.2 amps/cm² for 4 hours. Depths of the borided layers were 0.32, 0.34, and 0.32 mm, respectively, with this maximum depth occurring in a 60% B_2O_3 -bath. The greatest change in hardness was observed in the case of steel 10.

On the basis of these tests, this new method of boriding low- and high-carbon steels was recommended for industrial testing.

74. Diffusion and Oxidation Studies of the W-Be System

"Thermal Diffusion in the Tungsten-Beryllium System," by P. M. Arzhanyy, R. M. Volkova, and D. A. Prokoshkin; Moscow, Izvestiya Akademii Nauk SSSR, Otdeleniye Tekhnicheskikh Nauk, Metallurgiya 1 Toplivo, No 6, Nov/Dec 62, pp 162-166

Surface hardening, phase composition, diffusion processes, and energy characteristics were all included in a study of the thermal diffusion of beryllium in tungsten.

Three diffused layers of different thickness and hardness were noted. The initial layer, (WBe_2) has a hexagonal structure and a microhardness of 2,187 kg/mm²; the middle layer (WBe_{12}) has a body-centered tetragonal structure and hardness of 1,145 kg/mm²; and the external layer (WBe_{24}), also with a body-centered tetragonal structure, has a microhardness of 1,080 kg/mm². Thicknesses of the three layers were approximately 33, 25, and 78 microns, respectively.

From kinetics studies, it was observed that the diffusion process is frontal (into the metal) with the simultaneous formation of the layers. All layers formed according to the parabolic law, and whereas the composition of the first two layers remains fixed (at both diffusion temperature, 1,100°C, and room temperature), the beryllium content in the external layer decreases upon cooling due to the formation of two sublayers. One layer is a single-phase layer, and the other, double-phase, with the former being the outermost layer.

Kinetics of the oxidation of tungsten and the impregnated beryllium were studied at temperatures of 900-1,200°C by the continuous-weighing method. Oxidation time was 10 hours, with weight measurements taken every 15 minutes for the first 2 hours and every 30 minutes for the remaining time. A fine oxide film (10-15 Microns) forms on the surface of the sample, which tightly adheres to the base metal. Calculations of the free energy of formation ($BeO = 140$ kcal, $1/3 WO_3 = 60.6$ kcal) revealed that beryllium has a greater affinity for oxygen than tungsten.

75. Diffusion Saturation and the Development of Residual Stresses

"Development of Residual Stresses on the Surface of Steel by the Diffusion of Alloying Elements," by G. N. Dubinin and L. Gribovski, Moscow Aviation Institute; Moscow, Izvestiya Vysshikh Uchebnykh Zavededniy -- Chernaya Metallurgiya, No 11, Nov 62, pp 170-174

Investigation of residual stresses occurring in the surface layers of a metal in which another metal or metalloid has been diffused was conducted, using grade-10 steel as the base metal and aluminum, chromium, titanium, boron, and carbon as the diffusing elements.

C-O-N-F-I-D-E-N-T-I-A-L

Diffusion was accomplished by chemical and thermal treatment of the steel (carburizing, boriding, etc.). Depth and composition of the diffused layers and magnitude of the residual stresses occurring in the diffused layers were determined. In all cases, compressive stresses were found to exist close to the surface of the steel. These changed to tensile stresses, with the depth depending on the type of metal diffused.

The difference in the specific volumes of the diffusing elements and iron, more specifically the difference in atomic diameters, was given as the basic explanation for this particular case of strain hardening and change in the energy state of the surface layers of the alloy.

76. Effect of Carbon Diffused in Tungsten

"Diffusion Contamination of Tungsten by Carbon From a Graphite Lubricant," by L. N. Aleksandrov, Mordovskiy State University; Minsk, Inzhenerno-Fizicheskiy Zhurnal, Vol 5, No 9, Sep 62, pp 53-58

The diffusion of carbon into tungsten from a graphite lubricant at temperatures up to 900°C was investigated. The energy of activation for diffusion of carbon in tungsten was calculated to be 61.5 ± 1.5 kcal/g atom at $D_0 = 0.3$ cm²/sec. It was found that diffusion coefficients for the grains and boundaries could be determined separately.

An evaluation of the quantity of carbon diffused in a 5-micron layer of tungsten showed that in the process of wire and tube production, carbides were formed as a result of segregation of carbon atoms along grain boundaries and dislocations.

77. Solubility of Gases and Metals in Beryllium

"X-Ray Examination of the Solubility of Impurities in Beryllium," by V. M. Amonenko, V. Ye. Ivanov, G. F. Tikhinskiy, and V. A. Finkel', Physical and Technical Institute, Academy of Sciences USSR; Sverdlovsk, Fizika Metallov i Metallovedeniye, Vol 14, No 6, Dec 62, pp 852-856

The solubility of Ti, Zr, Y, and Ni in beryllium was investigated by X-ray analysis of hardened samples. Vacuum-distilled beryllium was used to produce binary alloys containing 1% Ti, Zr, and Y and 1.5% Ni. X-ray photographs were taken of pure beryllium and the alloys before heat treating and of the alloys after heat treating at various temperatures (20-900°C) in air and in a vacuum.

C-O-N-F-I-D-E-N-T-I-A-L

Analysis of the photographs showed that only nickel has any noted solubility in beryllium at room temperature. By determining the changes in the lattice parameters of beryllium in the two conditions of testing, it was found that the solubility of O_2 and N_2 had maximum value of 2-3% at $900^\circ C$. It was also noted that nickel reduces the solubility of both gases in beryllium at high temperatures.

Miscellaneous78. Study of Heavy-Metal Oxides and Their Reactions

"Investigation of Binary Oxides Containing Tungsten, Tantalum, and Niobium," by L. M. Kovba and V. K. Trunov, Moscow State University imeni M. V. Lomonosov; Moscow, Doklady Akademii Nauk SSSR; Vol 147, No 3, 21 Nov 62, pp 622-624

A study was made on thorium, cerium, and uranium dioxides reacted with tantalum and niobium pentoxide and tantalum pentoxide reacted with tungsten trioxide, from which new data were obtained on the reactions of uranium and tungsten oxides.

Oxide mixtures were heated to various temperatures in atmospheres of air or nitrogen and in a vacuum and the reaction products analyzed by X-ray diffraction, with the following observations noted:

1. Uranium, thorium, and cerium dioxides react with Nb_2O_5 and Ta_2O_5 to form compounds of the $\text{M}_\text{I}(\text{M}_\text{II}\text{O}_3)_4$ type where M_I is the metal from the dioxide and M_II is the pentoxide metal. These compounds have a structure similar to that of perovskite. The niobates have a lattice parameter "c" twice that of perovskite, while the parameter "a" remains unchanged. In the tantalates, these dimensions are reversed.

2. Cerium niobate is crystallized in an orthorhombic cell with a slight tendency toward tetragonal symmetry. Cerium tantalates have a superlattice which corresponds to the ordered position of tetravalent atoms in the form of pseudo-cubic twins.

3. The tantalates and niobates of uranium, cerium, and thorium have a structure very similar to the meta-tantalates and niobates of alkali and alkali-earth metals. This is explained by the large atomic radii of thorium, cerium, and uranium.

Tables for the oxide reaction, X-ray data on the niobates and tantalates, and X-ray data on W-Ta and W-Nb phases are given.

79. Investigation Into the Phenomena of Excess Modification of Silumin

"What Is Excess Modification of Silumin?" by Ye. A. Boom; Moscow, Tsvetnyye Metally, No 11, Nov 62, pp 89-92

The purpose of this investigation was to explain the phenomena which occur when silumin (AlSi) is modified with excess sodium, causing a detrimental effect on the mechanical properties of this alloy.

As a premise, the two stages of excess modification were distinguished: (1) for a small excess of sodium, the lattice structure of the alloy formed does not result in a strong reduction of the mechanical properties, especially ductility; (2) for a large excess of sodium, the coarse crystals of silicon and the tertiary silicide appear in the structure along with sections of the modified structure where hairline cracks appear and the mechanical properties of the alloy drop off sharply. Although the second stage of excess modification is seldom observed, it was discussed, along with the study of the first stage, from a theoretical point of view in order to make comparisons.

A step-by-step description of the processes involved in the cooling of silumin from the molten state and the subsequent crystal formation and growth is presented. It was found that the process is generally one of dendritic segregation, with the formation of eutectic spherulites, along with primary separations of silicon or sodium silicide and the tertiary eutectic of silicon-silicide. This is caused by rapid crystallization and entrapment of the excess sodium which forms alloys with the aluminum and silicon or remains in the form of a droplet and is crushed under the pressure of crystallization and distributed along the grain boundaries, causing a lowering of the grain boundary strength.

80. Investigation of Ti₆Al-Base Alloys for High-Temperature Service

"Long-Time Strength of Ti₆Al-Base Alloys," by I. I. Kornilov and T. T. Nartova; Moscow, Izvestiya Akademii Nauk, Otdeleniye Tekhnicheskikh Nauk, Metallurgiya i Toplivo, No 6, Nov/Dec 62, pp 142-146

The properties (tensile strength and %-elongation) of alloys TG-0, VT-4, VT-6, At₆4, and Ti₆Al and Ti₆Al-base alloys at various temperatures (20-700°C) and the creep of these alloys under a constant load of 20 kg/mm² are compared. The long-time strength of Ti₆Al-based alloys is compared to that of Eya-1T and EYaO stainless steels. It was shown that Ti₆Al-base alloys weaken slightly at 700°, as the density changes from 4.4 to 4.5 g/mm³.

One of the Ti₆Al-based alloys had the following properties at 20° and 700°, respectively; tensile strength, 75-80 and 60-65 kg/mm²; %-elongation, 4-8% and 12-13%. The long-time tensile strength of these alloys at 700°, up to 1,000 hours, is greater than for 18-8 steels.

It was proposed that Ti Al-base alloys which form an alpha-solid solution can serve as the basic, heat-resistant, titanium alloy for operating temperatures up to 700°C.

81. Investigation of YBi and YSb Alloys

"Determination of the Structure of YBi and YSb by X-ray Diffraction," by N. N. Zhuravlev and Ye. M. Smirnova, Moscow State University imeni M. V. Lomonosov; Moscow, Kristallografiya, Vol 7, No 5, Sep/Oct 62, pp 789-788

X-ray analysis of YBi and YSb crystals revealed that both compounds belong to the isometric system, with lattice constants 6.233 and 6.155 Å and densities of 8.07 and 5.93 g/cm³, respectively. Although a number of bismuth and antimony compounds are superconductors, an investigation of the bonding nature and interatomic distances of YBi and YSb alloys indicated that these alloys will not convert to the superconducting state.

82. Phase Diagram of the Ti-Nb-Cr System

"Phase Diagram of the Titanium-Niobium-Chromium System," by K. I. Shakhova and P. B. Budberg; Moscow, Izvestiya Akademii Nauk SSSR, Otdeleniye Tekhnicheskikh Nauk, Metallurgiya i Toplivo, No 6, Nov/Dec 62, pp 137-141

Phase equilibriums of the Ti-Nb-Cr system at the 600, 800, and 1000°C isotherms were investigated. It was found that the system contains one-two- and three-phase alloys, but the significant feature of the system was the quasi-binary phase, TiCr₂-NbCr₂, which existed throughout the portion of the ternary system investigated.

83. Stabilization of the Beta-Solid Solution in Zirconium Alloys

"Stabilization of the Beta-Solid Solution in Zirconium Alloys," by L. A. Petrova; Moscow, Izvestiya Akademii Nauk SSSR, Otdeleneiye Tekhnicheskikh Nauk, Metallurgiya i Toplivo, No 6, Nov/Dec 62, pp 159-161

The principles of solid solution formation in titanium were employed to produce a metastable beta-solid solution in zirconium alloys. Alloys having an electron concentration (average) of 4.2 electrons/atom were selected. Those elements having the required e.-c. value (or close to it) were vanadium (4.2), rhenium (4.15), molybdenum (4.1), and niobium (4.2). Vanadium and rhenium alloys form a beta-solid solution; however, this phase is not stable, nor is it continuous when the alloys are quenched to room temperature. Both molybdenum and niobium form the beta-solid solution, which is stable at room temperature, with molybdenum being twice as effective as niobium. The required atomic percent of these two elements in the zirconium alloy are 7.2% Mo and 15.0% Nb.

C-O-N-F-I-D-E-N-T-I-A-L

Conference

84. East German Conference on Hardening

"Central Conference on Hardening Technology in 1963"
(Berlin, Die Technik, No 2, Feb 63, p 122

The Specialized Committee on Hardening Technology of the Specialized Association of Machine Building of the East German Chamber of Technology announces that an international conference will be held in Eisenach on 25 and 26 April 1963.

The source states that the program of the conference will include lectures on the following topics given by the speakers indicated:

Minister H. Wundderlich: "The Significance of East Germany in Machine Building Within the Socialist Camp."

Engr Tauscher, Pirna: "On the Relationship Between Steel Production, Hot Forming, Heat Treatment, and Strength Characteristics of Structural Steel."

Engr Kunze, Karl-Marx-Stadt: "Frequency Errors in Heat Treatment -- Experiences of the DAMW Testing Laboratory for Metallurgy and Machine Building."

Engr Prenosil, Prague: "The Application of Cr-Mn-Ti Alloy Structural Steels."

Engr Stecher, Pirna: "The Dependence of Wear Characteristics on Hardness With Respect to Machine Parts and Tools."

Prof Dr Schumann, Rostok: "Utilization of ZTU Illustrations in Continuous Cooling During Heat Treatment of Large Forgings."

Prof Dr Schiebold, Magdeburg: "Investigations of Final Stages of Crank Shafts and Their Dependence on Steel Production, Hot Forming, and Heat Treatment."

Engr Seifert, Karl-Marx-Stadt: "Possibilities for Hardening the Beds of Machine Tools."

Engr Koch, Karl-Marx-Stadt: "Solubility Conditions of Graphite in Ferrite in Hardening of Cast Iron."

Engr Meinka, Karl-Marx-Stadt: "Induction Hardening of Gear Wheels After Universal Gear Hobbing."

C-O-N-F-I-D-E-N-T-I-A-L

Engr Meinka, Karl-Marx-Stadt: "Induction Hardening of Gear Wheels After Universal Gear Hobbing."

Engr Bardocz and Engr Schoen, Hungary: "Induction Hardening of Tools."

Engr Brackazek, Warsaw: "Utilization of Natural Gas in Carburization."

Smith, England: "Heat Treatment in Modern Furnaces."

Engr Hammer, Karl-Marx-Stadt: "Residual Stresses and Distortion in Hardened Components."

Engr Ruhle, Dresden: "Experience in the Measurement and monitoring of Temperatures With the Aid of Radiation Measuring Devices."

Beer, Zwickau: "Flame Hardening Machines Developed and Built by the RAW (Reichsbahn Repair Plant) at Zwickau."

* * *

7 September 2004

Ms. Roberta Schoen
Deputy Director for Operations
Defense Technical Information Center
7725 John J. Kingman Road
Suite 0944
Ft. Belvoir, VA 22060

Dear Ms. Schoen:

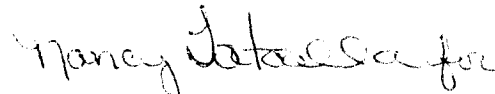
In February of this year, DTIC provided the CIA Declassification Center with a referral list of CIA documents held in the DTIC library. This referral was a follow on to the list of National Intelligence Surveys provided earlier in the year.

We have completed a declassification review of the "Non-NIS" referral list and include the results of that review as Enclosure 1. Of the 220 documents identified in our declassification database, only three are classified. These three are in the Release in Part category and may be released to the public once specified portions of the documents are removed. Sanitization instructions for these documents are included with Enclosure 1.

In addition to the documents addressed in Enclosure 1, 14 other documents were unable to be identified. DTIC then provided the CDC with hard copies of these documents in April 2004 for declassification review. The results of this review are provided as Enclosure 2.

We at CIA greatly appreciate your cooperation in this matter. Should you have any questions concerning this letter and for coordination of any further developments, please contact Donald Black of this office at (703) 613-1415.

Sincerely,



Sergio N. Alcivar
Chief, CIA Declassification Center,
Declassification Review and Referral
Branch

Enclosures:

1. Declassification Review of CIA Documents at DTIC (with sanitization instructions for 3 documents)
2. Declassification Status of CIA Documents (hard copy) Referred by DTIC (with review processing sheets for each document)



Processing of OGA-Held CIA Documents

The following CIA documents located at DTIC were reviewed
by CIA and declassification guidance has been provided.

OGA Doc ID	Job Num	Box	Fldr	Doc	Doc ID	Document Title	Pub Date	Pages	Decision	Proc Date
AD0335308	78-03117A	194	1	23	4363	Scientific Information Report Chemistry And Metallurgy (26)	3/7/1963	71	Approved For Release	3/25/2004
AD0335625	78-03117A	197	1	3	4460	Scientific Information Report Chemistry And Metallurgy (27)	4/4/1963	51	Approved For Release	3/25/2004
AD0336825	78-03117A	199	1	26	4562	Scientific Information Report Chemistry And Metallurgy (28)	5/9/1963	70	Approved For Release	3/25/2004
AD0332150	78-03117A	183	1	5	3916	Scientific Information Report Chinese Science (11)	10/4/1962	52	Approved For Release	3/29/2004
AD0332434	78-03117A	183	1	40	3951	Scientific Information Report Chinese Science (12)	10/19/1962	59	Approved For Release	3/29/2004
AD0332795	78-03117A	184	1	37	3988	Scientific Information Report Chinese Science (13)	11/5/1962	48	Approved For Release	3/29/2004
AD0333069	78-03117A	186	1	7	4028	Scientific Information Report Chinese Science (14)	11/16/1962	30	Approved For Release	3/29/2004
AD0333148	78-03117A	187	1	19	4078	Scientific Information Report Chinese Science (15)	11/29/1962	44	Approved For Release	3/29/2004
AD0333835	78-03117A	189	1	6	4144	Scientific Information Report Chinese Science (16)	12/21/1962	65	Approved For Release	3/29/2004
AD0334108	78-03117A	190	1	2	4179	Scientific Information Report Chinese Science (17)	1/10/1963	56	Approved For Release	3/29/2004
AD0334105	78-03117A	191	1	12	4230	Scientific Information Report Chinese Science (18)	1/18/1963	25	Approved For Release	3/29/2004
AD0334378	78-03117A	192	1	21	4277	Scientific Information Report Chinese Science (19)	2/1/1963	27	Approved For Release	3/29/2004
AD0334433	78-03117A	193	1	22	4322	Scientific Information Report Chinese Science (20)	2/15/1963	28	Approved For Release	3/29/2004
AD0335021	78-03117A	194	1	37	4377	Scientific Information Report Chinese Science (21)	3/8/1963	59	Approved For Release	3/29/2004
AD0335847	78-03117A	198	1	33	4526	Scientific Information Report Chinese Science (22)	4/18/1963	61	Approved For Release	3/29/2004
AD0336327	78-03117A	200	1	3	4578	Scientific Information Report Chinese Science (23)	5/2/1963	68	Approved For Release	3/29/2004
AD0337167	78-03117A	201	1	26	4643	Scientific Information Report Chinese Science (24)	5/23/1963	95	Approved For Release	3/29/2004
AD0337777	78-03117A	202	1	27	4687	Scientific Information Report Chinese Science (25)	6/6/1963	52	Approved For Release	3/29/2004
AD0338474	78-03117A	203	1	27	4727	Scientific Information Report Chinese Science (26)	6/20/1963	83	Approved For Release	3/29/2004
AD0338687	78-03117A	204	1	32	4772	Scientific Information Report Chinese Science (27)	7/5/1963	80	Approved For Release	3/29/2004
AD0339386	78-03117A	206	1	4	4820	Scientific Information Report Chinese Science (28)	7/17/1963	32	Approved For Release	3/29/2004
AD0339147	78-03117A	207	1	11	4862	Scientific Information Report Chinese Science (29)	7/30/1963	48	Approved For Release	3/29/2004
AD0340927	78-03117A	208	1	35	4924	Scientific Information Report Chinese Science (30)	8/21/1963	53	Approved For Release	3/29/2004
AD0341855	78-03117A	209	1	43	4974	Scientific Information Report Chinese Science (31)	9/5/1963	46	Approved For Release	3/29/2004
AD0342464	78-03117A	210	1	38	5013	Scientific Information Report Chinese Science (32)	9/16/1963	43	Approved For Release	3/29/2004
AD0342608	78-03117A	211	1	36	5054	Scientific Information Report Chinese Science (33)	9/27/1963	41	Approved For Release	3/29/2004