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Letter Circular
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DEPARTMENT OF COMMERCE

NATIONAL BUREAU OF STANDARDS

WASHINGTON

October 1, 1934

PUBLICATIONS ON THE PLATINUM METALS

There are listed below the publications of the National Bureau of Standards which deal directly, or incidentally, with platinum and the other metals of the platinum group, together with a few papers in the same field published by other Government laboratories. Those issued by the National Bureau of Standards are classified in five groups, according to the type of subject matter, as follows:

A. Chemistry
B. Metallurgy
C. Physical properties
D. Use in thermocouples and resistance thermometers, and for light standards
E. Use in chemical laboratory ware

The arrangement within each group is in the order of date of publication. A few papers are classified in two groups.

The publications for which a price is given can be obtained from the Superintendent of Documents, U.S. Government Printing Office, Washington, D. C., for the price indicated. (Stamps are not accepted in payment for Government publications).

With one or two exceptions, which are noted, reprints of papers appearing in scientific journals other than those issued officially by the Government are not available. These journals, as well as the Government publications which are out print, may be consulted in most of the larger technical, and some public, libraries.

If difficulty is experienced in gaining access to any publication, the Bureau will be glad to refer any inquirer to one or more libraries which have the publication in question.

A. CHEMISTRY

1. "The Preparation of Chloroplatinic Acid by Electrolysis of Platinum Black", by H.C.P. Weber, Pur. of Standards Sci. Papers S82. - Bulletin B.S. Vol. 4, p. 365 (1907). 3 pp. Out of print.

2. "The Preparation of Pure Platinum", by Edward Wichers, J. Am. Chem. Soc., Vol. 43, p. 1268 (1921). 5 pp. A few reprints available. This paper deals mainly with the precautions which must be taken to prevent contamination of platinum during melting. Superseded with respect to chemical purification by A-10.

3. "Practical Spectrographic Analysis", by W. F. Meggers, C.C. Kiess, and F. J. Stimson, Bur. of Standards Sci. Papers S444 - Vol. 18, p. 235 (1922). 21 pp. Out of print. This paper included a discussion of the spectrochemical analysis of platinum.

4. "Investigations on Platinum Metals at the Bureau of Standards, by Edward Wichers and Louis Jordan, Trans. Am. Electrochem. Soc., Vol. 43, p. 385 (1923). 12 pp. This paper deals mainly with the purpose and scope of the Bureau's investigations on the platinum metals at the time of its publication.

5. "Investigations on the Platinum Metals. IV. The Determination of Iridium in Platinum Alloys by the Method of Fusion with Lead", by Raleigh Gilchrist, J. Am. Chem. Soc., Vol. 45, p.2820 (1923). 9 pp. This paper is a condensed version of the next paper listed.

6. "Investigations on the Platinum Metals. IV. The Determination of Iridium in Platinum Alloys by the Method of Fusion with Lead", by Raleigh Gilchrist, Bur. of Standards Sci. Papers S483. - Vol. 19, p. 325 (1924). 21 pp. Price 5 cents.

7. "Investigations on the Platinum Metals. V. The Analytical Separation of Copper from the Platinum Metals", by Wm. F. Swanger and Edward Wichers, J. Am. Chem. Soc., Vol. 46, p. 1814 (1924). 4 pp.

8. "Investigations on the Platinum Metals. VI. The Analytical Separation of Rhodium from Platinum", by Edward Wichers, J. Am. Chem. Soc., Vol. 46, p. 1818 (1924). 16 pp. See also A-18.

9. "Analysis of Dental Gold Alloys", by William F. Swanger, Bur. of Standards Sci. Papers S532. - Vol. 21, p. 209 (1926). 31 pp. Price 10 cents. This procedure includes methods for the determination of platinum metals in dental alloys.

10. "Purification of the Six Platinum Metals", by Edward Wichers, Raleigh Gilchrist and William H. Swanger, Trans. Am. Institute of Mining and Metallurgical Engineers, Vol. 76, p. 602 (1928). 29 pp. Obtainable from the American Institute of Mining and Metallurgical Engineers, 29 W. 39th St., New York City, as Technical Publication No. 87, for 29 cents per copy.

This is the only paper in the list which deals with the chemical processes by which each of the metals can be prepared in any desired degree of purity. Although not intended as a treatise on commercial platinum refining, the methods described can be adapted to commercial operations. Later modifications of the processes for purifying iridium and rhodium are given in papers C-19 and C-22.

11. "A Gravimetric Method for the Determination of Ruthenium", by Raleigh Gilchrist, B.S. Jour. Research, Vol. 3, p. 993 (1929) (Research Paper 125). 11 pp. Price 5 cents.

12. "The Chloroplatinate - Chloroplatinite Electrode", by Edgar R. Smith, B.S. Jour. Research, Vol. 5, p. 735 (1930). (Research Paper 225). 6 pp. Price 5 cents.

13. "A Method for the Separation and Gravimetric Determination of Osmium", by Raleigh Gilchrist, B.S. Jour. Research, Vol. 6, p. 421 (1931) (Research Paper 286). 28 pp. Price 10 cents.

14. "A New Determination of the Atomic Weight of Osmium", by Raleigh Gilchrist, B.S. Jour. Research, Vol. 9, p. 279 (1932) (Research Paper 471) 12 pp. Price 5 cents.

15. "A Method sof the Separation of Rhodium from Iridium and the Gravimetric Determination of these Metals", by Raleigh Gilchrist, B.S. Jour. Research, Vol. 9, p. 547 (1932). (Research Paper 489).9 pp. Price 5 cents.

16. See C-19.

17. "A Method for the Separation of Ruthenium from Platinum, Palladium, Rhodium, and Iridium, by Raleigh Gilchrist, B.S. Jour. Research, Vol. 12, p. 283 (1934) (Research Paper 654). 8 pp. Price 5 cents.

18. "Methods for the Separation of Platinum, Palladium, Rhodium, and Iridium from One Another and for their Gravimetric Determination ", by Raleigh Gilchrist, B.S. Jour. Research, Vol. 12, p. 291 (1934) (Research Paper 655). 13 pp. Price 5 cents.

19. See C-22.

20. "A New System of Analytical Chemistry for the Platinum Metals", by Raleigh Gilchrist and Edward Wichers. This paper was presented before the Section on Pure Analytical Chemistry at the Ninth International Congress of Pure and Applied Chemistry, Madrid, Spain, April 5 to 11, 1934. It will appear in the proceedings of the Congress. A few reprints will be available at a later date.

B. METALLURGY

1. "Preparation of Platinum and of Platinum-Rhodium Alloys for Thermocouples", by Robert P. Heville, Trans. Am. Electrochem. Soc., Vol. 43, p. 371 (1923). 12 pp.

2. "Refractories for Melting Pure Metals; Iron, Nickel, Platinum", by L. Jordan, A. A. Peterson, and L. H. Phelps, Trans. Am. Electrochem. Soc., Vol. 50, p. 155 (1926). 9 pp. This paper is superseded by B-4.

3. "Melting, Mechanical Working, and Some Physical Properties of Rhodium", by Wm. H. Swanger, B.S. Jour. Research, Vol. 3, p. 1029 (1929) (Research Paper 127). 12 pp. Price 10 cents.

4. "Special Refractories for Use at High Temperatures", by Wm. H. Swanger and Frank R. Caldwell, B.S. Jour. Research, Vol. 6, p. 1131 (1931) (Research Paper 327). 13 pp. Price 10 cents. This paper includes a description of the special crucibles used for melting the platinum metals.

C. PHYSICAL PROPERTIES

1. "Optical Pyrometry", by C. W. Waidner and G. K. Burgess, Bur. of Standards Sci. Papers S11. - Bulletin B.S. Vol. 1, p. 189 (1905). 61 pp. Out of print. This paper includes a section on radiation from platinum.

2. "Radiation from Platinum at High Temperatures", by G. K. Burgess, Bur. of Standards Sci. Papers S24. - Bulletin B.S. Vol. 1, p. 443 (1905). 3 pp. Out of print.

3. "Radiometric Investigations of Infra-Red Absorption and Reflection Spectra", by W. W. Coblentz, Bur. of Standards Sci. Papers S45. - Bulletin B.S. Vol. 2, p. 457 (1907). 22 pp. Out of print. Included in this paper are the determinations of the reflecting power of palladium and of iridium in the form of plane mirrors.

4. "Radiation from and Melting Points of Palladium and Platinum", by C. W. Waidner and G. K. Burgess, Bur. of Standards Sci. Papers S55. - Bulletin B.S. Vol. 3, p. 163 (1907). 46 pp. Out of print.

5. "Radiation Constants of Metals", by W. W. Coblentz, Bur. of Standards Sci. Papers S 105. - Bulletin B.S. Vol. 5, p. 339 (1908). 40 pp. Out of print. A spectrobolometric investigation of the radiation constants of various metals, including osmium and platinum.

6. "Selective Radiation from Various Substances, IV", by W.W. Coblentz, Bur. of Standards Sci. Papers S191. - Bulletin B.S. Vol. 9, p. 81 (1912). 37 pp. Price 10 cents. Included in this paper are determinations of the radiation constants of platinum.

7. "The Diffuse Reflecting Power of Various Substances", by W. W. Coblentz, Bur. of Standards Sci. Papers S196. - Bulletin B.S. Vol. 9, p. 283 (1912). 43 pp. Out of print. Included in this paper are determinations of the reflecting power of platinum black, produced by electrolytic deposition on sheet platinum.

8. "The Emissivity of Metals and Oxides. II. Measurements with the Micropyrometer", by G. K. Burgess and R. G. Waltenberg, Bur. of Standards Sci. Papers S242. - Bulletin B.S. Vol. 11, p. 591 (1914). 15 pp. Out of print. "Palladium shows an undercooling radiation phenomenon and the discontinuity of platinum at the melting point would render the Violle unit of light uncertain."

9. "The Emissivity of Metals and Oxides. III. The Total Emissivity of Platinum and the Relation Between Total Emissivity and Resistivity", by Paul D. Foote, Bur. of Standards Sci. Papers S243. - Bulletin B.S. Vol. 11, p. 607 (1915). 6 pp. Out of print.

10. See A-3.

11. See A-4.

12. "Investigations on the Platinum Metals. VII. Arc Spectra of the Platinum Metals (4500 A to 9000A)", by W. F. Meggers, Bur. of Standards Sci. Papers S499. - Bulletin B.S. Vol. 20, p. 19 (1925). 27 pp. Price 10 cents.

13. "Absorption Spectra of the Palladium and Platinum Triads", by W. F. Meggers and Otto Laporte, Physical Review, Vol. 28, p. 642 (1926). 23 pp.

14. "A New Determination of the Melting Point of Palladium", by C. O. Fairchild, W. H. Hoover, and N. F. Peters, B.S. Jour. Research, Vol. 2, p. 931 (1929) (Research Paper 65). 32 pp. Price 10 cents.

15. "The Spark Spectrum of Ruthenium", by W. F. Meggers and A. G. Shenstone, Physical Review, Vol. 35, p. 868 (1930). A half page article in Physical Review, under "Letters to the Editor". The only published work on the analysis of the spectrum Ru II.

16. See D-6.

17. "The Freezing Point of Platinum", by Wm. F. Roeser, F. R. Caldwell, and H. T. Wensel, B.S. Jour. Research, Vol. 6, p. 1119, (1931) (Research Paper 326). 11 pp. Price 5 cents.

18. "Thermoelectric Properties of Platinum-Rhodium Alloys", by Frank R. Caldwell, B.S. Jour. Research, Vol. 10, p. 373, (1933) (Research Paper 537). 8 pp. Price 5 cents.

19. "The Freezing Point of Iridium", by F. Henning and H. T. Wensel, B.S. Jour. Research, Vol. 10, p. 809 (1933) (Research Paper 568). 13 pp. Price 5 cents. Appendix deals with the preparation of pure iridium.

20. "Der Erstarrungspunkt von Iridium", by F. Henning and H.T. Wensel, Ann. Physik, 5 Folge, Bd. 17, Heft 6, S. 620 (1933). 15 pp. This paper is the German translation of the preceding paper, except for the appendix, which is omitted.

21. "Some Physical Properties of Platinum-Rhodium Alloys", by J. S. Acken, B.S. Jour. Research, Vol. 12, p. 249 (1934) (Research Paper 650). 9 pp. Price 5 cents.

22. "Freezing Point of Rhodium", by Wm. F. Roeser and H. T. Wensel, B.S. Jour. Research, Vol. 12, p. 519 (1934) (Research Paper 676). 8 pp. Price 5 cents. Appendix deals with the preparation of pure rhodium.

23. See D-8.

24. See D-9.

D. USE IN THERMOCOUPLES AND RESISTANCE THERMOMETERS, AND FOR LIGHT STANDARDS

1. "Platinum Resistance Thermometry at High Temperatures", by C. W. Waidner and G. K. Burgess, Bur. of Standards Sci. Papers S124. - Bulletin B.S. Vol. 6, p. 149 (1909). 82 pp. Out of print.

2. "Standardization of Rare Metal Thermocouples", by Paul D. Foote, T. R. Harrison, and C. O. Fairchild, Met. Chem. Eng., Vol. 18, p. 343 (1918). 6 pp.

3. "Recent Modifications in the Construction of Platinum Resistance Thermometers", by T. S. Sligh, Jr., Bur. of Standards Sci. Papers S407. - Bulletin B.S. Vol. 17, p. 49 (1921). 15 pp. Price 5 cents.

4. "Life Tests of Platinum: Platinum-Rhodium Thermocouples", by C. O. Fairchild and H. F. Schmitt, Chem. Met. Eng., Vol. 26, p. 158 (1922). 4 pp.

5. "The International Temperature Scale", by George K. Burgess, B.S. Jour. Research, Vol. 1, p. 635 (1928) (Research Paper 22). 6 pp. Price 5 cents.

6. "The Waidner-Burgess Standard of Light", by H. T. Wensel, Wm. F. Roeser, L. E. Barbrow, and F. R. Caldwell, B.S. Jour. Research, Vol. 6, p. 1103 (1931) (Research Paper 325). 15 pp. Price 5 cents.

7. "Reference Tables for Platinum to Platinum-Rhodium Thermocouples", by Wm. F. Roeser and H. T. Wensel, B.S. Jour. Research, Vol. 10, p. 275 (1933) (Research Paper 530). 13 pp. Price 5 cents.

8. "Establishment of a Scale of Color Temperature", by H. T. Wensel, D. B. Judd, and Wm. F. Roeser, B.S. Jour. Research, Vol. 12, p. 527 (1934) (Research Paper 677). 10 pp. Price 5 cents.

9. "Derivation of Photometric Standards for Tungsten Filament Lamps", by H. T. Wensel, Wm. F. Roeser, L. E. Barbrow, and F. R. Caldwell, B.S. Jour. Research, Vol. 13, p. 161 (1934) (Research Paper 699). 8 pp. Price 5 cents.

E. USE IN CHEMICAL LABORATORY WARE.

1. "Preliminary Report of the Committee on Quality of Platinum Laboratory Utensils", by W. F. Hillebrand, Percy H. Walker, and E. T. Allen, J. Ind. Eng. Chem., Vol. 3, p. 686 (1911). NOTE - See in this connection, "Platinum Laboratory Utensils", by Percy H. Walker and F. W. Smither, U.S. Bureau of Chemistry Bulletin No. 137, pp. 180-181 (1910).

2. "A Thermoelectric Method for the Determination of the Purity of Platinum Ware", by G. K. Burgess and P. D. Sale, J. Ind. Eng. Chem., Vol. 6, p. 452 (1914). 7 pp.

3. "A Study of the Quality of Platinum Ware with Special Reference to Losses on Heating", by G. K. Burgess and P. D. Sale, J. Ind. Eng. Chem., Vol. 7, p. 561 (1915). 11 pp.

4. "A Study of the Quality of Platinum Ware", by G. K. Burgess and P. D. Sale, Bur. of Standards Sci. Papers S254. - Bulletin B.S. Vol. 12, p. 289 (1915). 28 pp. Out of print.

5. "Further Experiments on the Volatilization of Platinum", by G. K. Burgess and R. G. Waltenberg, Bur. of Standards Sci. Papers S280. - Bulletin B.S. Vol. 13, p. 365 (1916). 9 pp. Prive 5 cents.

6. "Comparative Tests of Palau and Rhotanium Ware as Substitutes for Platinum Laboratory Utensils", by L. J. Gurevich and E. Wichers, J. Ind. Eng. Chem., Vol. 11, p. 570 (1919). 9 pp.

The following publications of the U.S. Bureau of Mines deal with the platinum metals. Those for which prices are indicated can be purchased from the Superintendent of Documents, Washington, D.C.

1. "The Manufacture of Sulphuric Acid in the United States", by A. E. Wells and D. E. Fogg, Bureau of Mines Bulletin 184, (1920). 216 pp. Price 40 cents. This bulletin includes information on the use of platinum in the manufacture of sulphuric acid.

2. "Notes on the Black Sand Deposits of Southern Oregon and Northern California", by R. H. Fornor, Bureau of Mines Technical Paper 196, (1918). 42 pp. Out of print. Describes examinations made to determine whether deposits contain sufficient platinum and gold to be profitable and to discover if any iron minerals are present.

3. "The Detection and Estimation of Platinum in Ores", by C. W. Davis, Bureau of Mines Technical Paper 270, (1921). 27 pp. Out of print. Intended as a ready reference to assayers. Gives a selected method for the commercial estimation of platinum in ores.

4. "Methods for the Recovery of Platinum, Iridium, Palladium, Gold and Silver from Jewelers' Waste", by C. W. Davis, Bureau of Mines Technical Paper 342, (1924). 14 pp. Price 5 cents.

5. "The Estimation of Small Quantities of Gold, Silver, and the Platinum Metals in Material High in Copper", by C. W. Davis, Bureau of Mines Reports of Investigations 2228, (1921). 5 pp. Out of print.

6. "Separation of Palladium and Platinum by Means of Dimethylglyoxime", by C. W. Davis, Bureau of Mines Reports of Investigations 2351, (1922). 2 pp. Out of print.

7. "Platinum Assays and Platinum Promotions", by S. C. Lind, C. W. Davis, and M. W. von Bernewitz, Bureau of Mines Reports of Investigations 2496, (1923). 21 pp. Out of print. Issues warning to public to be wary of helping to promote projects for mining platinum ores without careful assay of specimens.

8. "Platinum", by P. M. Tyler and R. M. Santmyers, Bureau of Mines Information Circular 6389, (1931). 69 pp. Obtainable free on request addressed to Publications Section, U. S. Bureau of Mines, Washington, D. C. This publication gives general information on production, uses, and occurrence of platiniferous ores.

9. Beginning with 1924, the Bureau of Mines issued the annual publication "Mineral Resources of the United States", published before that time by the U.S. Geological Survey. In 1932 this series was superseded by the "Minerals Yearbook". These publications contain annual chapters on "Platinum and Allied Metals", which are largely devoted to information on production of the metals throughout the world, quantities imported into and exported from the United States, and statistics on uses and prices. The separate chapters are available from the Superintendent of Documents. The last one issued is for 1932, by C. W. Davis and H. W. Davis. The price is 5 cents.

The U.S. Geological Survey also has issued a number of publications dealing with the platinum metals, some of which are listed below:

1. "The Geological Relations and Distribution of Platinum and Associated Metals", by J. F. Kemp, U.S. Geological Survey Bulletin 193,(1902), 95 pp. Out of Print.

2. "A Gold-Platinum-Palladium Lode in Southern Nevada", by Adolph Knopf, U.S. Geological Survey Bulletin 620, part a, (1916), 18 pp. Out of print.

3. "Our Mineral Supplies" - Chapter on Platinum, by J. M. Hill, U.S. Geological Survey Bulletin 666 (d), (1917), 4 pp. Price 5 cents.

4. "Bibliography of the Metals of the Platinum Group, 1748-1917", by J. L. Howe and H. C. Holtz, U.S. Geological Survey Bulletin 694. 558 pp. Out of print. This is the most comprehensive work of its kind.

5. Prior to 1924 the annual publication "Mineral Resources of the United States", with separate chapters on "Platinum and Allied Metals", was published by the U.S. Geological Survey. In addition to statistical information on production, imports, etc., some of these publications contain brief treatments of special topics such as the following:

1883-84, "Iridium, Methods of Working and Uses", with bibliography.

1913, "Occurrence of Platinum in Lode Deposits".

1914,"Methods of Determination, Assay, and Field Tests".

1915, "Mining and Metallurgy of Platinum".

1916, "Hints to Prospectors, (with Tests)".

1920, "Platinum Assaying".

All of the foregoing papers are out of print.

6. "Platinum - Hints for Prospectors", U.S. Geological Survey free circular 68896, 6 pp (mimeographed). Free on request to the U.S. Geological Survey, Washington, D. C.

7. "Beach Placers of the Oregon Coast", U.S. Geological Survey Circular 8, (1934), 41 pp. (mimeographed). Obtainable from U.S. Geological Survey, Washington, D.C.

Additional references to publications of the U.S. Geological Survey in this field can be found in mimeographed circular 34549, which is a complete bibliography of publications on platinum and allied metals issued by the Geological Survey.