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A BIBLIOGRAPHY ON THE DETERMINATION OF
NITROGEN BY ACTIVATION ANALYSIS

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ABSTRACT

This bibliography on the determination of nitrogen by activation analysis contains references to articles, bibliographies, books, reviews, and reports. The references were obtained from Nuclear Science Abstracts, Chemical Abstracts, and Chemical Titles for the period January 1951 through June 1967, inclusive.

A BIBLIOGRAPHY ON THE DETERMINATION OF NITROGEN BY ACTIVATION ANALYSIS

Introduction

This bibliography on the determination of nitrogen by activation analysis is a compilation of articles, bibliographies, books, reviews, and reports. The references were obtained from Nuclear Science Abstracts, Chemical Abstracts, and Chemical Titles for the period January 1951 through June 1967, inclusive. The bibliography is arranged alphabetically according to first author.

The index contains the following sections: Matrix, Nuclear Reaction, Interference, Cross Section, and General References.

1. Activation analysis. Comparative bibliography. Cahier d'Information du Bureau EURISOTOP 5. Série: Bibliographies 1. Brussels, Bureau EURISOTOP-EURATOM, 1965. 46 p. NSA: 20, 22955.
2. Adams, F., and Hoste, J., Non-destructive activation analysis. At. Energy Rev. 4(2), 113-80 (1966). NSA: 20, 35420.
3. Adolff, J. P., Schleiffer, J. J., and Urlacher, C. Analytical applications of the reactions (α , n). Bull. soc. chim. France 1966 (2), 698-703. CA: 65, 14h.
4. Albert, P. L'Analyse par la Radioactivation. Paris: Gauthier-Villars, 1963. CA: 61, 8901d.
5. Albert, P. Activation analysis with γ photons and charged particles. Chimia 21, 116-125 (1967).
6. Albert, P. The use of reactions induced by accelerated protons, deuterons, helions, and gamma photons in radioactivation analysis for the determination of oxygen, carbon, and nitrogen in metals. Proc. Intern. Conf. Mod. Trends Activation Anal., College Station, Texas, 1961, p. 78-85. NSA: 17, 39003.
7. Albert, P., Deschamps, N., Fournet, L., and Deyris, M. Use of short-lived radioisotopes to determine impurities in aluminum, iron, and zirconium of very high purity. IAEA Preprint SM-32/31. 18 p. NSA: 17, 4480.

8. Albert, P., Engelmann, C., May, S., and Petit, J. Activation analysis of oxygen, carbon, and nitrogen with the (γ, n) reaction. *Compt. rend.* 254, 119-21 (Jan. 1962). NSA: 16, 12986.
9. Amiel, S. Neutron counting in activation analysis. *Proc. Intern. Conf., Peaceful Uses At. Energy*, 3rd Geneva, 1964, 15, 462-73 (1965). CA: 65, 4634e.
10. Amiel, S. Activation analysis with a nuclear reactor, not based on (n, γ) reactions. (Israel. At. Energy Comm., Rehovoth). Apr. 1963. 35 p. (IA-839) NSA: 17, 27230.
11. Amiel, S., and Peisach, M. Analytical aspects of delayed neutron emission. (Israel. At. Energy Comm., Rehovoth). Oct. 1962. 35 p. (IA-784) NSA: 17, 10534.
12. Annual Report. "Studies in photonuclear reactions. (Pennsylvania Univ., Philadelphia). Oct. 15, 1959. 15 p. NP-8037 NSA: 14, 2967.
13. Ashby, V. J., Catron, H. C., Newkirk, L. L., and Taylor, C. J. Absolute measurement of $(n, 2n)$ cross sections at 14.1 Mev. *Phys. Rev.* 111, 616-21 (July 1958). NSA: 12, 16667.
14. Aubouin, G., Gauzzoni, P., and Laverlochere, J. Use of 14 mev neutrons in activation analysis: experiments carried out at the Grenoble nuclear research center. *Comm. Energie At. (France)*, Rappt. CEA 2358, 16 p. (1963). CA: 60, 12647d.
15. Babikova, Y. F., Minaev, V. M., and Samosadnyi, V. T. Neutron activation method for determination of some impurities in steel. *Zavodsk. Lab.* 32(1), 47-9 (1966). CA: 64, 16622b.
16. Baldwin, G. C., and Clark, L. B. Radioactivity induced in yeast by 100 mev X-radiation. *Science* 117, 9-10 (1953). NSA: 7, 2464.
17. Benjamin, R. W., England, L. D., Blake, K. R., Morgan, I. L., and Huston, C. D. Deuteron activation analysis for C, N, and O in high-purity metallic surfaces. *Trans. Amer. Nucl. Soc.* 9, 104 (June 1966). NSA: 20, 33238.
18. Berezin, A. K., Vitozhents, G. C., Sulin, V. V., and Shornikov, S. I. γ -Activation analysis of rock samples. *Proc. Symp. Radiochem. Methods Anal.*, Salzburg, Austria, 1964, 1, 361-89 (1965). CA: 63, 15541a.
19. Berton, M. Activation analysis with particle accelerators. *Comm. Energie At. (France)*, Serv. Doc., Ser. Bibliog. No. 50, 125 p. (1964). CA: 62, 11131a.
20. Blake, K. R., Martin, T. C., Morgan, I. L., and Huston, C. D. The measurement of surface contamination of high-purity beryllium samples. *Proc. Intern. Conf. Mod. Trends Activation Analysis*, College Station, Texas, 1965, p. 76-81. NSA: 19, 40453.

21. Blake, K. R., Parker, C. B., England, L. D., and Morgan, I. L. Elemental trace analysis by charged particle and neutron activation. Aug. 1966. 48 p. (ORO-2980-14) NSA: 20, 40812.
22. Bock-Werthmann, and Schulze, W., comps. Activation analysis. Series C: Selected references according to subject. (Hahn-Meitner-Institut für Kernforschung, Berlin) May 15, 1961. 280 p. (AED-C-14-1). NSA: 19, 9051.
23. Bock-Werthmann, W., comp. Activation analysis. Series C: Selected references according to subject. (Hahn-Meitner-Institut für Kernforschung, Berlin) May 15, 1962. 226 p. (AED-C-14-02) NSA: 19 9052.
24. Bock-Werthmann, W., comp. Activation analysis. Series C: Bibliographies. (Hahn-Meitner-Institut für Kernforschung, Berlin) Feb. 1964. 216 p. (AED-C-14-03) NSA: 18, 37074.
25. Bollman, W., and Zündt, W. Cross-section measurements of the $^{14}\text{N}(n, \alpha)^{11}\text{B}$ and $^{14}\text{N}(n, p)^{14}\text{C}$ processes with monochromatic D-D neutrons. Helv. Phys. Acta 24, 517-50 (1951). CA: 46, 2418e.
26. Bormann, M., and Fretwurst, E. Investigations on the energy dependence of some neutron reactor cross sections. (NP-13930 p. 43-9) NSA: 18, 24602.
27. Bowen, H. J. M., and Gibbons, D. Radioactivation Analysis. New York: Oxford University Press, 1963. NSA: 18, 25310.
28. Bradshaw, W., Johnson, R., and Beard, D. Beryllium analyzed for trace impurities by gamma-ray activation. Jan. 1960. 25 p. LMSD-288231 NSA: 14, 23837.
29. Brill, O. D. Cross section for the reactions of helium-3 with light nuclei. Yadern. Fiz. 1(1), 55-60 (1965). CA: 62, 14099d.
30. Brill, O. D., Vlasov, N. A., Kalinin, S. P., and Sokolov, L. S. Cross-section for the (n, 2n) reaction on ^{12}C , ^{14}N , ^{16}O , and ^{19}F in the 10 to 35 mev energy range. Doklady Akad. Nauk S. S. S. R. 136, 55-7 (Jan. 1961). NSA: 15, 15062.
31. Broda, E., and Rohringer, G. Effective cross section of carbon-13 for thermal neutrons and a method for nitrogen determination by activation. Naturwissenschaften 40, 337-8 (1953). CA: 48, 6277f.
32. Buckingham, B. R. S., Parker, K., and Pendlebury, E. D. Neutron cross sections of selected elements and isotopes for use in neutronics calculations in the energy range 0.025 ev - 15 mev. Mar. 1961 221 p. (AWRE-0-28/60) NSA: 15, 18725.
33. Cadwell, D. O. Nitrogen in metals. Rev. Sci. Instruments 23, 501-2 (1952). NSA: 6, 6616.
34. Cevolani, M., and Petralla, S. Cross-section measurement of (n, 2n) reactions on 14.1 mev neutrons. Nuovo Cimento 26, 1328-38 (1962). CA: 58, 8577g.

35. Chemistry semi-annual summary research report for July-December 1958. (Ames Lab., Ames, Iowa). April 1959. 68 p. ISC-1116 NSA: 13, 18894.
36. Cherubeni, J. H. Fast activation analysis with Van de Graaff neutron source including tabulation of fast-neutron activation characteristics of the isotopes. May 1962. 20 p. (NP-13761) NSA: 18, 15955.
37. Cohen, B. L. (n, 2n) and (n, p) cross sections. Phys. Rev. 81, 184-8 (1951). CA: 45, 2786g.
38. Coleman, R. F., and Pierce, J. B. Activation analysis: A review. Analyst 92, 1-19 (1967). NSA: 21, 10269.
39. Comparative bibliography on activation analysis (Final Report). (Société Atome Industriel, Paris). 1964. 288 p. (EUR-188.6f) NSA: 19, 5768.
40. Csikai, J. Investigation of nuclear reactions with 14 mev neutrons. At. Kozlem. 8, 79-86 (June 1966). NSA: 20, 46614.
41. Cüer, P., Lonchamp, J. P., and Gorodetzky, S. Determination of the cross section for the disintegration of nitrogen by thermal neutrons. J. phys. radium 12, 6S-7S (Feb. 1951). NSA: 5, 6877.
42. Dibbs, H. P. Activation analysis with a neutron generator. Mines Branch Research Report R 155. Ottawa: Queen's Printer and Controller of Stationery, 1965. 91 p. NSA: 19, 42448.
43. Eichelberger, J. F., Grove, G. R., and Jones, L. V. Mound Laboratory Progress Report for May 1965. 36 p. (MLM-1266) NSA: 20, 3879.
44. Engelmann, C. Particles other than neutrons in activation analysis. Comm. Energie At. (France), Rappt. CEA-R2559 (1964) 53 p, CA: 62, 13825d.
45. Engelmann, C., and Cabane, G. Activation with photons or charged particles for the analysis of non-metallic elements. Proc. Intern. Conf. Mod. Trends Activation Anal., College Station, Texas, 1965, p. 331-6. NSA: 21, 12327.
46. Engelmann, C., Gosset, J., and Loeuillet, M. Routine activation analysis of some common impurities in beryllium. Bull. soc. chim. France 1965(2), 544-7 (Feb. 1965). NSA: 19, 24415.
47. Engelmann, M., and Schaub, B. Activation analysis of very high purity beryllium obtained by zone melting. Symp. Zonenschmelzen Kolonnenkristallisieren, Karlsruhe, Ger., 1963, 247-75. CA: 63, 3610g.
48. Ferguson, G. A., Halpern, J., Nathans, R., and Yergin, P. F. Photoneutron cross sections in He, N, O, F, Ne, and A. Phys. Rev. 95, 776-80 (1954). NSA: 8, 5948.
49. Ferguson, J. M., and Thompson, W. E. Cross sections for the (n, 2n) reaction in ¹⁴N, ³¹P, ⁶³Cu, and ¹⁴¹Pr. Phys. Rev. 118, 228-32 (1960). CA: 54, 23892g.

50. Gabbard, F., Bichsel, H., and Bonner, T. W. The distintegration of nitrogen by fast neutrons. Nucl. Phys. 14, 277-94 (1959). NSA: 14, 8102.
51. Gadda, F., comp. A bibliographic search on radioactivation analysis. Jan. 1961. 72 p. (CISE-83) NSA: 15, 14210.
52. Gibbons, D., Loveridge, B. A., and Millett, R. J. Radioactivation analysis: A bibliography. (Gt. Britain At. Energy Res. Estab.) Aug. 1957. 38 p. AERE-I/R-2208 NSA: 12, 2233.
53. Gibbons, D., Mapper, D., Millett, R. J., and Simpson, H. Radioactivation analysis: A bibliography, first supplement. (Gt. Britain At. Energy Res. Estab.) Oct. 1960. 36 p. (AERE-I/R-2208 (suppl. 1)) NSA: 15, 5951.
54. Gibbons, D., and Olive, G. Applications of a neutron generator in radioactivation analysis. At. Energy Estab. AERE-R4576 (1963). 7 p. CA: 61, 6366a.
55. Gilmore, J. T., and Hull, D. E. Nitrogen-13 in hydrocarbons irradiated with fast neutrons. Anal. Chem. 34, 187-90 (Feb. 1960). NSA: 16, 7494.
56. Girardi, F. Some recent developments in radioactivation analysis. A review of improvements in the analytical technique. Talanta 12, 1017-41 (Nov. 1965). NSA: 20, 1785.
57. Girardi, F., Guzzi, G., and Pauly, J. Data Handbook for Sensitivity Calculations in Neutron Activation Analysis. Brussels: Presses Acad. Européennes, 1965. CA: 64, 16635f.
58. Golchert, N. W., Gardner, D. G., and Sedlet, J. Cross sections of some reactions of ^{99}Tc with 14.1 mev neutrons. Nucl. Phys., 73, 349-52 (1965). NSA: 19, 45325.
59. Gowing, R. M. An investigation of the thermal neutron cross section for the reaction $^{14}\text{N}(n, p) ^{14}\text{C}$ using a nuclear emulsion technique. June 1961. 67 p. (NP-12658) NSA: 17, 22561.
60. Grimeland, B., Kjellsby, E., and Vines, J. Cross sections of some reactions induced in nitrogen, phosphorus, copper, and bromine with neutrons of energy 14.8 mev. Phys. Rev. 137B, 878-82 (Feb. 1965). NSA: 19, 12592.
61. Guinn, V. P. Reactor-produced short-lived radioisotopes used in neutron activation analysis. IAEA Preprint SM-32/27 21 p. NSA: 17, 6026.

62. Guinn, V. P. Activation analysis with a research reactor. New developments. Proc. Conf. Anal. Chem. Nucl. Reactor Technol., 6th, Gatlinburg, Tenn., 1962. (TID-7655 (p1-11)). NSA: 17, 40698.
63. Guinn, V. P. Advances in neutron activation analysis. Proc. Intern. Conf. Peaceful Uses At. Energy, 3rd, Geneva, 1964. 15, 433-44 (1965). CA: 65, 7978h.
64. Guinn, V. P. Advances in neutron activation analysis. Isotopes and Radiation Technology 2(4), 329-39 (1965). NSA: 19, 36287.
65. Hanna, G. C., Primeau, D. B., and Tunnicliffe, P. R. Thermal neutron cross sections and resonance integrals of the reactions $^{17}\text{O}(n, \alpha)^{14}\text{C}$, $^{36}\text{Ar}(n, \alpha)^{33}\text{S}$, and $^{14}\text{N}(n, p)^{14}\text{C}$. Can. J. Phys. 39, 1784-1806 (Dec. 1961). NSA: 16, 4757.
66. Heertje, I., Delvenne, L., Nagel, W., and Aten, Jr, A. H. W. Cross sections of some (n, p) and (n, 2n) reactions. Physica 30, 1762-70 (Sept. 1964). NSA: 19, 5230.
67. Heslop, J. A. B. Activation analysis of light elements by means of charged particles. April 1961. 14 p. (NP-11608) NSA: 16, 20321.
68. Hull, D. E., and Gilmore, J. T. Computer routines for neutron activation analysis of lubricating oils. Anal. Chem. 36, 2072-7 (Oct. 1964). NSA: 18, 39074.
69. Johns, H. E., Horsley, R. J., Haslam, R. N. H., and Quinton, A. Gamma-neutron cross sections for ^{14}N and ^{16}O . Phys. Rev. 84, 856-7 (Nov. 1951). NSA: 6, 1332.
70. Kenna, B. T., and Conrad, F. J. Tabulation of cross sections, Q values, and sensitivities for nuclear reactions of nuclides with 14 mev neutrons. June 1968 42 p. (SC-RR-66-229) NSA: 20, 32380.
71. King, J. D., Haslam, R. N. H., and Parsons, R. W. The gamma-neutron cross sections for ^{14}N . Can. J. Phys. 38, 231-9 (Feb. 1960). NSA: 14, 8949.
72. Kloster, R. L., and Wells, M. B. Neutron cross sections for nitrogen and oxygen. May 1963. 97 p. (NARF-62-17T) NSA: 17, 39976.
73. Koch, R. C. Activation Analysis Handbook. New York: Academic Press, 1960. NSA: 15, 5973.

74. Kuan, H., and Risser, J. R. Excitation function of the $^{14}\text{N}(p, n)^{14}\text{O}$ total cross section from threshold to 12 mev. Nucl. Phys. 51, 518-27 (1964). NSA: 18, 17061.
75. Kusaka, Y., Tsuji, H., and Adachi, T. Experimental sensitivity data for radioactivation analysis with 14 mev neutrons. Bull. Chem. Soc. Japan 36, 1259-61. (Oct. 1963). NSA: 18, 11997.
76. Kusaka, Y., Tsuji, H., Fujii, I., Muto, H., and Miyoshi, K. Gamma-ray spectrometry in radioactivation analysis with 14 mev neutrons. Bull. Chem. Soc. Japan 38, 616-24 (1965). CA: 63, 12303a.
77. Laverlochere, J. Activation analysis applied to nuclear materials. Chim. Anal. 46, 23-30 (Jan. 1964). NSA: 18, 29577.
78. Leddicotte, G. W. Nucleonics. Anal. Chem. 36(5), 419R-53R (April 1964). NSA: 18, 19867.
79. Lyon, W. S., Ricci, E., and Ross, H. H. Nucleonics. Anal. Chem. 38(5), 251R-261R (1966). CA: 65, 1717b.
80. MacLeod, A. M., and Reid, J. M. Proton nuclear reaction cross sections in nitrogen at 13 mev. Proc. Phys. Soc. (London) 87, 437-44 (Feb. 1966). NSA: 20, 19941.
81. Maddock, R. S., and Meinke, W. W. Activation analysis; nuclear chemical research; radiochemical separations; Progress Report No. 10, Nov. 1960-Oct. 1961. Nov. 1961. 165 p. (TID-14310) NSA: 16, 2967.
82. Mahony, J. D., Bahman, P., and Markowitz, S. Activation analysis for carbon and nitrogen by ^3He induced nuclear reactions. 1963 (UCRL-11213 (p. 87-90)) NSA: 18, 31361.
83. Marion, J. B., Brugger, R. M., and Bonner, T. W. (d, n) reactions in ^{16}O and ^{14}N . Phys. Rev. 100, 46-51 (Oct. 1955). NSA: 10, 395.
84. Matthews, C. O. Beryllium research in missile development. J. Metals 12, 780-15 (Oct. 1960). NSA: 15, 672.
85. Merz, E. Activation analysis with fast neutrons using a mobile neutron generator. Atomstrahlung in Medizin und Technik. Munich: Verlag Karl Thiernig K G, 1964. p. 211-16. NSA: 18, 36565.
86. Möller, E., Nilsson, L., and Starfelt, N. Microanalysis of light elements by means of (d, n) reactions. Nucl. Instr. and Methods 50, 270-6 (1967).

87. Morgan, I. L., Ashe, J. B., Prud'homme, J. T., and Martin, T. C. Activation analysis for impurities in beryllium. Jan. 1964. 80 p. (ASD-TDR-62-1038 (Pt. III) (Vol. 1)). NSA: 18, 43368.
88. Moses, A. J. Nuclear Techniques in Analytical Chemistry. New York: The Macmillan Company, 1964. NSA: 19, 19822.
89. Naumova, I. I. Determination of nitrogen and boron by activation with fast neutrons. Zavodsk. Lab. 31(10), 1205-7 (1965). CA: 64, 2728d.
90. Nelligan, W. B., and Tittman, J. High-stability gamma-ray spectrometer for use at high-counting rates. IRE Trans. on Nucl. Sci. 5, 187-90 (1958). CA: 53, 10858a.
91. Nozaki, T., Okuo, T., Akutsu, H., and Furukawa, M. The radioactivation analysis of semi-conductor graphite for nitrogen by the $^{14}\text{N}(p, \alpha)^{11}\text{C}$ reaction. Bull. Chem. Soc. Japan 39, 2685-90 (1966). NSA: 21, 5807.
92. Nozaki, T., and Yazawa, K. The radioactivation analysis of graphite for nitrogen by the $^{14}\text{N}(p, \alpha)^{11}\text{C}$ reaction. Bull. Chem. Soc. Japan 37, 1891-2 (1964). NSA: 19, 15371.
93. Orear, J., Rosenfeld, A. H., and Schuller, R. A., Eds. Gamma-rays and photonuclear reactions, Sect. V of nuclear physics and the physics of fundamental particles; Proceedings of the International Conference, Sept. 17-22, 1951. (Institute for Nuclear Studies, Univ. of Chicago) 27 p. (NP-3591 (Sect. V)) NSA: 6, 1861.
94. Oshry, H. I. Fast neutron activation analysis with a portable source. Proc. Intern. Conf. Mod. Trends Activation Anal., College Station, Texas, 1961, p.28-31. NSA: 17, 38998.
95. Paul, E. B., and Clarke, R. L. Cross-section measurements of reactions induced by neutrons of 14.5 mev energy. Can. J. Phys. 31, 267-77 (1953). CA: 47, 4755c.
96. Peisach, M. The determination of carbon, nitrogen, and oxygen in gases by neutron time of flight spectroscopy. Chem. Commun. 1966(8), 632-3 (1966). CA: 66, 16295g.
97. Perijon, J. Experimental sensitivities in neutron activation and gamma spectroscopy with a 150-kv accelerator. Anal. Chem. 39, 448-56 (Apr. 1967).
98. Prasad, R., Sarkar, D. C., and Khurana, C. S. Measurement of (n, p) and (n, α) reaction cross sections at 14.8 mev. Nucl. Phys. 85(2), 476-80 (1966). CA: 65, 8252b.

99. Progress Report for July, August, September 1958. (Columbia Univ., New York). 64 p. CU-178 NSA: 13, 13702.
100. Raleigh, H. D. Activation analysis. (A Literature Search) (Division of Technical Information Extension, AEC) Aug. 1963. 30 p. (TID-3575) NSA: 17, 33801.
101. Rasmussen, N. C., and Thompson, T. J. Neutron and gamma-ray spectroscopy and activation analysis. Feb. 1966. 176 p. (AD-633252) NSA: 20, 29078.
102. Ray, J. H., Grochowski, G., and Troubetzkoy, E. S. Neutron cross sections of nitrogen, oxygen, aluminum, silicon, iron, deuterium and beryllium. Nov. 1965. 211 p. (UNC-5139) NSA: 20, 44661.
103. Rayburn, L. A. 14.4 mev (n, 2n) cross sections. Phys. Rev. 122, 168-71 (Apr. 1961). NSA: 15, 16483.
104. Ricci, E., and Hahn, R. L. Sensitivities for activation analysis of 15 light elements with 18 mev helium-3 particles. Anal. Chem. 39(7), 794-7 (1967).
105. Ricci, E., and Hahn, R. Theory and experiment in rapid, sensitive helium-3 activation analysis. Anal. Chem. 37, 742-8 (May 1965). NSA: 19, 22114.
106. Ricci, E., and Hahn, R. L., Sensitivities for ^3He activation analysis determination of light elements ($Z=4$ to 20). Trans. Amer. Nucl. Soc. 9, 104-5 (June 1966). NSA: 20, 33239.
107. Rocco, G. G., Garzon, O. L., and Cali, J. P. Non-destructive determination of nitrogen in diamond by photoactivation. Intern. J. Appl. Radiation Isotopes. 17(8), 433-40 (1966). CA: 65, 12845d.
108. Rommel, H. Determination of boron in silicon and germanium by proton and deuteron activation. Anal. Chim. Acta 34(4), 427-46 (1966). CA: 64, 18389e.
109. Rubin, S., Passell, T. O., and Bailey, L. E. Chemical analysis of surfaces by nuclear methods. Sept. 1956. 34 p. NP-6120 NSA: 11, 107.
110. Schulze, W. Neutron activation analysis as an analytical method. Die Chemische Analyse. Band 50. Stuttgart: Ferdinal Enke Verlag, 1962. NSA: 19, 13260.

111. Shamaeu, V. I. Determination of nitrogen in organic compounds by activation with fast neutrons. Tr. 1-go(Pervogo) Vses. Koordinats. Soveshch. po Aktivatsionnomu Analizu, Inst. Yadern. Fiz., Akad. Nauk Uz. SSR, Tashkent 1962, 45-9 (1964). CA: 63, 4937f.
112. Sorantin, H. Progress of instrumental analysis by using radioactive nuclides. Radex Rundschau 1965(5), 658-71. CA: 64, 11831f.
113. Spira, J. Photon activation analysis of cesium. From 9th Conf. Anal. Chem. Nucl. Technology, Gatlinburg, Tenn. 18 p. (CONF-651004-9). ORINS. NSA: 20, 20645.
114. Steele, E. L., and Meinke, W. W. Fast neutron activation analysis. Proc. Intern. Conf. Mod. Trends Activation Anal., College Station, Texas, 1961, p. 161-5. NSA: 17, 4479.
115. Stehn, J. R., Goldberg, M. D., Magurno, B. A., and Wiener-Chasman, R. Neutron cross sections. I. Z=1 to 20. 252 p. (1964). BNL-325 (2nd Ed.) (Suppl. 2)(Vol. I). CA: 62, 9983c.
116. Strain, J. E., and Ross, J. W. 14-mev neutron reactions. U.S. At. Energy Comm. ORNL-3672, 61 p. 1965. CA: 63, 1439a.
117. Sue, P. Determination of nitrogen by the nuclear reaction $^{14}\text{N}(d, n)^{15}\text{O}$. Compt. rend. 240, 88-90 (1955). NSA: 9, 2179(J).
118. Sue, P. Use of d, n and d, α reactions in some light elements for analytical means. Compt. rend. 242, 770-1 (Feb. 1965). NSA: 10, 5902.
119. Taylor, D. Neutron Irradiation and Activation Analysis. Princeton, N. J.: D. Van Nostrand Co., Inc., 1964. NSA: 19, 11040.
120. Tilbury, R. S. Activation analysis with charged particles. 43 p. (1966). (NAS-NS-3110) CA: 66, 15822f.
121. Tilbury, R. S., and Wahl, W. H. Activation analysis by high energy particles. Nucleonics 23(9), 70-8 (Sept. 1965). NSA: 19, 42442.
122. Tittman, J., Nelligan, W. B., Antkiw, S., and Johnson, F. F. Nuclear determination of nitrogen content. Mar. 10, 1964. U.S. Patent 3,124,679. NSA: 18, 13713.
123. Tralli, N., Kalos, M. H., Longano, A. J., Ray, J. H., Sullivan, R. P., Troubetzkoy, E. S., and Trupin, B. H. Neutron cross sections for titanium, potassium, magnesium, nitrogen, aluminum, silicon, sodium, oxygen, and manganese. Jan. 1962. 123 p. (UNC-5002) NSA: 16, 24796.

124. Tsuji, H. Radioactivation analysis of nitrogen and phosphorus with 14 mev neutrons. Jap. Anal., 263-8 (1966). NSA: 20, 20596.
125. Vuletin, J., and Cindro, N. Cross sections for some (n, 2n) reactions. Glasnik Mat. -Fiz. Astron., Ser. II, 19, 269-73 (1964). NSA: 19, 39797.
126. Walker, L. J., and Eggebratten, V. L. Correlation of physical properties of rubber with nitrogen content by means of neutron-activation analysis. Proc. Intern. Conf. Mod. Trends Activation Anal., College Station, Texas, 1965, p. 169-71. NSA: 21, 12309.
127. Wood, D. E. Fast neutron activation analysis for nitrogen in grain products. 33 p. (1965). KN-65-186 CA: 65, 15979h.
128. Wood, D. E. Selected references for neutron activation analysis. 11 p. (1965). (NP-15637) NSA: 20, 5499.
129. Yule, H. P. Reactor neutron activation analysis. Instrumental sensitivities in six matrix materials. Anal. Chem. 38(7), 818-21 (1966). CA: 65, 4634b.
130. Yule, H. P., Lukens, Jr., H. R., and Guinn, V. P. Utilization of reactor fast neutrons for activation analysis. Dec. 1964. 90 p. (GA-5978) NSA: 19, 32058.

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