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**SODIUM IODIDE AND SODIUM  
IODIDE CRYSTALS:  
THEIR USE IN SCINTILLATION  
COUNTING AND SPECTROMETRY**

**A Bibliography**

**Prepared by**

**Robert R. Kepple**

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THEIR USE IN SCINTILLATION COUNTING  
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The arrangement is alphabetical by title, and personal author and subject indexes are included.



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NSA53-4633  
In a study of afterglow it was found that, in addition to very short-lived traps in NaI(Tl), there exist at least two long-lived groups ranging in lifetime from 60 sec. to perhaps 100 min. Most if not all characteristics of the afterglow of NaI(Tl) can be accounted for by the shallow trap-deep model of phosphorescent materials. The long-lived traps contribute a spectral shift away from the fluorescence wavelengths that increases in magnitude with time after excitation. Partial optical discrimination against afterglow is possible. Quenching of some afterglow components should be possible. The very long-lived afterglow probably is associated with F-center formation and subsequent bleaching.
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NSA54-4431

Narrow beam geometry attenuation measurements have been made with the 6.13-Mev  $\gamma$  rays from  $N^{16}$  using a NaI scintillation spectrometer detector. The measured absorption coefficients in  $\text{cm}^2/\text{gm}$  are:..., 0.0350 (NaI). The statistical standard deviations range from 0.2% to 0.4%.

83. GAMMA-RAY ABSORPTION COEFFICIENTS FOR NaI, Cu, Ta, AND W. P. R. Howland and W. E. Kregar (U.S. Naval Radiological Defense Lab., San Francisco, Calif.) Phys. Rev. 95, 407-10 (1954) July 15.

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Gamma-ray absorption coefficients have been measured over a range of energies from 0.279 Mev through 1.113 Mev for NaI, Cu, Ta and W; using an energy selective scintillation detector.

84.  $\gamma$ -RAY DOSIMETRY WITH ORGANIC SCINTILLATORS. R. T. Carrand, G. J. Hine. (Mass. Inst. of Tech.) Nucleonics 11, No. 11, 53-5, 68 (1953).

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Anthracene (I) and NaI scintillators were used with com. photo-multiplier tubes to attain air-equiv. dosage measurements for  $\gamma$ -ray emitters. For  $\gamma$  rays between 0.6 and 2.0 Mev the value of I/D remained nearly const. for a 2.5 cm NaI crystal since Compton absorption predominates over photoelec. and pair-production attenuation in this energy region.

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D. Maeder and R. Muller. Helv. Phys. Acta 29, 446-8 (1956)  
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A thin wall Al vessel contained a crystal of NaI(Tl) 13 cm. in diam. and 10 cm. high. It was surrounded by 50% of xylene contg. 4g. terphenyl/l and 0.01 g. diphenylhexatriene/l. The inner walls of the vessel were coated with an evapd. film of MgO for increased reflection. Without the shielding soln., the intensity ratios were 10:5:1 for the primary, and 2 secondary rays from Co<sup>60</sup>; with the soln., the ratios were 10:1:0.
  
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Several exptl. devices were developed: gaseous target, a device for resolving gamma coincidences by means of 2 NaI(Tl) crystals.
  
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95. HOLLOW NaI(Tl) CRYSTAL FOR DETERMINING WEAK GAMMA ACTIVITY. J. Nagy and R. Voszka. Magyar Fiz. Folyoirat 6, 483-6 (1958) (Translated from Referat. Zhur. Fiz. No. 2, 1960, abstract No. 2770)  
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96. IRE TRANSACTIONS ON NUCLEAR SCIENCE. VOLUME NS-3, NO. 4. SCINTILLATION COUNTER SYMPOSIUM HELD FEB. 28-29 (1956) IN WASHINGTON, D. C. N. Y., The Institution of Radio Engineers, Inc. 1956.  
NSA57-6482  
Papers are included on recent developments on the background radiation detected by NaI crystals.

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When a scintillation counter is used as a spectrometer for energetic protons, corrections must be made for the fact that (p,n) and other nuclear reactions may occur in the scintillator, causing some of the protons to register substandard pulse heights. These corrections were measured for thalliated sodium iodide.

98. INSTRUMENT RESEARCH AND DEVELOPMENT DIVISION QUARTERLY REPORT: DECEMBER, 1951. JANUARY AND FEBRUARY, 1952. Argonne National Lab. ANL-4778. p. 11.

NSA52-2974

Describes several improvements that have been made in the technique of packaging NaI(Tl) crystals for scintillation gamma-ray spectrometry.

99. INSTRUMENT RESEARCH AND DEVELOPMENT QUARTERLY PROGRESS REPORT FOR PERIOD ENDING APRIL 20, 1952. Oak Ridge National Lab. ORNL-1336

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Graphs are presented of the energy resolution of gamma rays by a scintillation spectrometer consisting of a 5819 photo-multiplier tube on which is mounted any of various-sized NaI crystals.

100. INSTRUMENTATION AND CONTROLS DIVISION ANNUAL PROGRESS REPORT FOR PERIOD ENDING JULY 1, 1959. Nov. 2, 1959. Oak Ridge National Lab. ORNL-2787, p. 64-7

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109. LARGE-CRYSTAL COUNTING, NaI(Tl) SCINTILLATION SPECTROMETER. M. A. Van Dilla. Nucleonics 17-150 Nov. 1959.

Description of a scintillation spectrometer used for measuring radioactivity in man and employing a large NaI(Tl) crystal (4-9 in. diam. and a few inches thick).

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144. MICROWAVE SPECTRA OF THE ALKALI HALIDES. A. Honig et al. Phys. Rev. 96, 629-42 (1954)  
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145. MOISTURE PROOFING OF LUMINESCENT THALLIUM-ACTIVATED SODIUM IODIDE. M. J. Toogood (to E. K. Cole, Ltd.) British Patent 796,187 Nuclear Eng. 4, 48 (1959) Jan.  
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146. MOLECULAR ASSOCIATION IN ALKALI HALIDE VAPORS (thesis) S. Datz. Oak Ridge National Lab. May 31, 1960. ORNL-2933  
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147. MOUNTING OF A NaI-Tl CRYSTAL IN AN AIR-TIGHT CASE. B. Mougín. Letter in J. Phys. Radium 16, No. 4, 339 (April 1955) (In French)  
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148. MULTIPLE CRYSTAL GAMMA-RAY SPECTROSCOPY USING NaI-Tl CRYSTALS. J. K. Bair et al. 2/13/51 NEPA Div. NEPA-647
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NSA56-1507  
Efficiencies were calculated for NaI crystals, and the variation of efficiency with gamma energy is shown for crystals of various sizes.
150. NRL QUARTERLY ON NUCLEAR SCIENCE AND TECHNOLOGY. PROGRESS REPORT FOR THE PERIOD JULY-SEPT. 1957. Naval Research Lab., Washington, D.C. p. 20-23. NP-6650.  
NSA58-7999  
A study of photons in NaI(Tl) scintillation counters. Using Monte Carlo calculations, a study has been made of the energy lost in NaI(Tl) scintillation crystals by photons up to 1.5 Mev in energy.



151. NRL QUARTERLY ON NUCLEAR SCIENCE AND TECHNOLOGY. PROGRESS REPT. FOR THE PERIOD OCT.-DEC. 1955. Naval Research Lab., Wash., D. C. NP-5876.

NSA56-5898

Using Monte Carlo calculations, a study was made of the energy lost in NaI(Tl) scintillation crystals by photons from 0.1 to 1.5 Mev.

152. NATURE OF EXCITATION SPECTRA OF SOME CRYSTALLOPHOSPHORS. F. D. Klement and A. F. Malysheva. Trudy Inst. Fiz. i Astron., Akad. Nauk. Eston S.S.R. 1955, No. 1, 44-56 (In Russian)

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The excitation of luminescence of Pb-activated phosphors with a Cd halide base resulted from the absorption of the excitation light by the ions of the activator. Similar conclusion was drawn from the observation of luminescence of NaI(Tl) and KI(Tl) phosphors.

153. NEUTRON PHYSICS DIVISION ANNUAL PROGRESS REPORT FOR PERIOD ENDING SEPT. 1, 1959. Oak Ridge National Lab. ORNL-2842

NSA60-2804

p. 181-184 Nonproportionality of response of an NaI(Tl) scintillation crystal to gamma rays.

p. 191-192 Comparison of experimental gamma-ray responses of an 8 in. diam. NaI(Tl) crystal with calculated responses.

154. NEW STUDIES ON THE PHYSICAL PROPERTIES OF ORGANIC AND MINERAL SCINTILLATORS. L. Koch et al. p. 53-6 of "Nuclear Electronics. I" (In French)

NSA60-5406

The effects of the mode of excitation on the decay time was investigated for silver-activated zinc sulfide, NaI(Tl) and CsI(Tl) and the natural phosphor  $\text{CaF}_2$ .

155. NONLINEAR RESPONSE OF NaI(Tl) TO PHOTONS. D. Engelkemeir. Rev. Sci. Instr 27, 589-91 (1956) Aug.

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156. NOTE ON THE ESCAPE PEAK CORRECTION FOR NaI(Tl) CRYSTALS. W. E. Meyerhof and H. I. West, Jr. Rev. Sci. Instr 25, 1025 (1954) Oct.

157. NUCLEAR CHEMICAL RESEARCH RADIOCHEMICAL SEPARATIONS AND ACTIVATION ANALYSIS. PROGRESS REPORT NO. 7 FOR NOV. 1957 - OCT. 1958. Michigan Univ. Dept. of Chemistry. AECU-3887

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A description is given of a three inch scintillation crystal detector and housing. The resolution of the 3 in. x 3 in. NaI(Tl) crystal was determined as a function of gamma energy.

158. NUCLEAR MAGNETIC RESONANCE STUDIES OF DISLOCATIONS IN NaI and KI. J. F. Hon and P. J. Bray. J. Appl. Phys. 30, 1425-8 (1959) Sept.

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Intensity anomalies were found in the nuclear magnetic resonance of  $I^{127}$  in NaI and KI single crystals when the magnetic field is along a (1,0,0) type direction. These studies afford an explanation of anomalous resonance line widths reported for NaI by other observers.

159. OBSERVATION OF NONPROPORTIONALITY OF RESPONSE FOR A NaI(Tl) SCINTILLATION CRYSTAL. R. W. Peelle and T. A. Love. Dec. 7, 1959. Oak Ridge National Lab. ORNL-2801

NSA60-3861

160. ON DISTORTIONS OF COMPLETE ENERGY LINES BY NaI(Tl) CRYSTALS. Y. A. Nemilov et al. Pribory i Tekh. Ekspt. No. 4, 72-3 (1959) July- Aug. (In Russian)

NSA59-21113

Studies were made of the observed "doubling" caused by some NaI(Tl) crystals in complete energy lines. The expanded "doubling" is shown graphically. It was found that moisture and reorientation can cause the doubling effect.

161. ON PROBLEMS OF LINEARITY IN SCINTILLATION SPECTROMETRY. I. SCINTILLATION REACTION OF INORGANIC CRYSTALS TO GAMMA EXCITATION. Y. A. Nemilov et al. Izvest Akad. Nauk S.S.S.R. Ser. Fiz. 23, 257-62 (1959) Feb. (In Russian)

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162. ON THE ENERGY RESOLUTION OF SCINTILLATION COUNTERS. L. S. Kukushkin and A. M. Ratner. Translated by Lydia Venters (ANL) from Zhur. Tekh. Fiz. 28, 345-50 (1958) 11 p. AEC-tr-3339

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163. ON THE ENERGY RESOLUTION OF SCINTILLATION COUNTERS. II. A. M. Ratner and L. S. Kukushkin. Zhur. Tekh. Fiz. 28, 1121-5 (1958) May (In Russian)

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164. ON THE ENERGY RESPONSE AND RESOLUTION OF A SCINTILLATION COUNTER. S. Dhar, Indian J. Phys. 29, No. 7, 329-51. July, 1955.  
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165. ON THE GROWING OF SPECTROMETRIC CRYSTALS ACCORDING TO THE METHOD DEVELOPED BY KYROPOULOS. L. M. Belyaev, et al. Izv. Akad. Nauk S.S.S.R., Ser Fiz., 22, No. 1, 21-2 (1958) (In Russian) English summary. PB 14041T-1  
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168. ON THE V-CENTERS IN ALKALI IODIDE CRYSTALS. Y. Uchida and Y. Nakai. J. Phys. Soc. Japan 9, No. 6, 928-34 (Nov.-Dec. 1954)  
SA55-3271  
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170. OPTICAL STUDIES ON THALLIUM-ACTIVATED ALKALI-IODIDE CRYSTALS. Y. Uchida and R. Kato. J. Phys. Soc. Japan 14, 1408-14 (1959) Oct.  
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174. PEAK EFFICIENCY OF NaI(Tl) CRYSTALS FOR GAMMA RAYS FROM 0.150 TO 7.5 Mev. N. H. Lazar et al. IRE TRANS. NUCLEAR SCI NS-3, No. 4, 136-7 (1956) Nov.  
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175. PHOTOELECTRIC ABSORPTION OF GAMMA RAYS IN THALLIUM ACTIVATED SODIUM IODIDE. K. E. Johansson. Arkiv Fysik 10, 247-78 (1955) (In English)  
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176. PHOTOGRAPHY OF COSMIC RAY TRACKS WITH A CASCADE LUMINESCENT CHAMBER. Rept. No. 2900-11-T. L. W. Jones and M. L. Perl. May, 1959. AD-216789  
NSA60-7974  
A cascade luminescent chamber made up of three image tubes coupled with refractive optics was used to photograph tracks of cosmic ray  $\mu$  mesons in a sodium iodide crystal.
177. PHOTOLUMINESCENCE OF THE SUBLIMATE PHOSPHOR NaI(Tl). K. V. Shalimova. Doklady Akad. Nauk S.S.S.R. 66, 851-4 (1949)  
CA49-7348h
178. PHOTOPROTON SCINTILLATION SPECTROMETER. A. L. Whetstone et al. Rev. Sci. Instr. 29, 415-19 (1958)  
CA59-12042b
179. PHYSICAL CONSTANTS OF THE ALKALI HALIDES OF THE NaCl TYPE. K. Spangenberg. Naturwissenschaften 43, 394 (1956)  
CA59-17642e
180. PHYSICS DIVISION PROGRESS REPORT FOR JAN. 1 TO MAR. 31, 1959. AECL-830. Atomic Energy Division of Canada, Ltd. Chalk River. PR-P-41  
NSA59-16314  
A study was made of the frequency wavelength relationship for elastic waves traveling in single crystals of lead and sodium iodide.
181. PHYSICS DIVISION PROGRESS REPORT APRIL 1, 1959 TO JUNE 30, 1959. AECL-888. Atomic Energy Division of Canada, Ltd. Chalk River. PR-P-42. p. 42  
NSA60-1913  
Lattice vibrations in sodium iodide.

182. PHYSICS DIVISION QUARTERLY PROGRESS REPORT FOR PERIOD  
ENDING SEPT. 20, 1952. Oak Ridge National Lab. ORNL-1415. p. 10  
NSA53-2009  
Ratio of peak to total for a thallium-activated sodium iodide  
crystal.
  
183. PHYSICS DIVISION SEMIANNUAL PROGRESS REPORT FOR PERIOD  
ENDING SEPT. 10, 1953. Oak Ridge National Lab. ORNL-1620  
NSA54-1910  
A Tl activated NaI crystal has been made to give good resolution  
and its use as a self-coincident detector has already been shown  
to be very helpful in decay scheme determinations.
  
184. PHYSICS DIVISION SEMIANNUAL PROGRESS REPORT FOR PERIOD  
ENDING MARCH 10, 1954. Oak Ridge National Lab. ORNL-1705 p. 11  
NSA54-4986  
Gamma-ray spectrum and gamma-ray yield from boron  
bombarded by protons.
  
185. PHYSICS DIVISION SEMIANNUAL PROGRESS REPORT FOR PERIOD  
ENDING SEPT. 10, 1955. Oak Ridge National Lab. ORNL-1975  
NSA56-3144  
The peak efficiency of various NaI(Tl) crystals is given as  
a function of gamma energy.
  
186. PHYSICS DIVISION SEMIANNUAL PROGRESS REPORT FOR PERIOD  
ENDING MARCH 10, 1956. J. F. Fowler and E. O. Wollan, eds.  
Oak Ridge National Lab. ORNL-2076. p. 55  
NSA56-6755  
Extension of peak efficiency of 3 x 3 in. NaI(Tl) crystal to  
high energies.
  
187. PHYSICS DIVISION SEMIANNUAL PROGRESS REPORT FOR PERIOD  
ENDING SEPT. 10, 1956. Oak Ridge National Lab. ORNL-2204. p. 57  
NSA57-4016  
Variation of NaI(Tl) detection efficiencies with crystal size  
and geometry for medical research.
  
188. POLISHING AND SETTING OF SODIUM IODIDE (Tl) CRYSTALS.  
G. Mathe. Magyar Fiz. Folyoirat 6, 369-71 (1958)  
CA59-863h
  
189. POLISHING TECHNIQUES FOR NaI(Tl). C. A. Stone et al. Rev.  
Sci. Instr 22, 1027 (1951) Dec.  
NSA52-1810



190. PREPARATION AND PERFORMANCE OF SOME SCINTILLATION CRYSTALS. J. A. Harshaw et al. Sept. 10, 1952. Harshaw Chem. Co. NYO-1577

NSA52-6414

The work covers study of thallium-activated sodium iodide to determine the effect of production variables on operation and to develop production methods of finishing and mounting this material to obtain good performance.

191. PREPARATION OF SINGLE CRYSTAL OF THALLIATED SODIUM IODIDE. R. Kiyama and K. Shimizu. Rev. Phys. Chem. Japan 27, 68-70 (1957)

CA58-14272h

192. PREPARING THIN SODIUM IODIDE CRYSTALS WITH A MICROTOME. L. Cranberg (nd). Los Alamos Scientific Lab. AECU-2290; LADC-1278

NSA53-527

193. PRESSURE EFFECTS IN LUMINESCENCE: ISOBARIC EXPERIMENTS ON NaI(Tl). L. Reiffel. Phys. Rev. 114, 1493-9 (1959) June 15

NSA59-22747

194. PRESSURE EFFECTS IN PHOSPHORESCENCE. L. Reiffel. Phys. Rev. 94, 856 (1954) May 15

NSA54-4330

195. PROCEEDINGS OF THE LARGE CRYSTAL SPECTROMETRY SYMPOSIUM HELD IN CINCINNATI, OHIO, MAY 23, 1958. J. G. Carver, comp. General Electric Co. ANP Dept.

NSA59-10141

An informal symposium on the subject of gamma-ray spectroscopy through the use of large (9 x 9 in.) single crystals of sodium iodide (Tl activated).

196. PRODUCTION TECHNIQUE FOR LONG SECTIONS OF SODIUM IODIDE (thallium) SCINTILLATION CRYSTALS. D. J. Chleck. Rev. Sci. Instr. 28, 288-9 (1957).

197. PROGRESS REPORT FOR OCTOBER 1 TO DECEMBER 31, 1958. AECL-770. Atomic Energy of Canada, Ltd. Chalk River, PR-P-40.

NSA59-10154

A detailed study of the frequency-wavelength relation for elastic waves travelling in single crystals of silicon and sodium iodide was accomplished using the new neutron diffraction crystal spectrometer at the NRU reactor and the rotating crystal spectrometer at NRX.

198. PROGRESS REPORT (NO. 54) COVERING THE PERIOD FOR PHYSICS AND CHEMISTRY THROUGH APRIL 30, 1959. Mass. Inst. of Tech. Lab for Nuclear Science. AECU-4525. p. 96  
NSA60-6071  
A brief description of a new coated unactivated NaI scintillator and a new photomultiplier which have been put into operation.
199. PROTECTIVE CONTAINERS FOR NaI(Tl). L. Reiffel et al. Rev. Sci. Instr. 22, 1026-7 (1951) Dec.  
NSA52-1811
200. THE PULSE HEIGHT DISTRIBUTION FROM A SODIUM IODIDE SINGLE CRYSTAL SCINTILLATION COUNTER AND THE MEASUREMENT OF GAMMA RAY FLUXES. C. M. Griffiths. Can. J. Physics 33, 209-18 (1955) May.  
NSA55-4534
201. PULSE HEIGHT SPECTRUM PRODUCED IN SODIUM IODIDE BY NUCLEAR GAMMA RAYS OF VARIOUS ENERGIES. W. M. Good et al. Phys. Rev. 83, 239-40 (1951)  
CA53-6775a
202. QUARTERLY PROGRESS REPORT FOR MTR TECHNICAL BRANCHES, SECOND QUARTER, 1957. J. E. Evans, ed. Phillips Petroleum Co. Atomic Energy Div., Idaho Falls. IDO-16394  
NSA57-13430  
In the decay scheme program, studies on the efficiencies of 3 x 3 in. NaI crystals have been continued.
203. QUARTERLY PROGRESS REPORT FOR MTR-ETR TECHNICAL BRANCHES. THIRD QUARTER, 1957. K. A. McCollom, ed. Phillips Petroleum Co. Atomic Energy Div., Idaho Falls. IDO-16430  
NSA58-8064  
In the decay schemes program, the machine calculated detection efficiencies of sodium iodide scintillation crystals are being checked experimentally.
204. QUARTERLY PROGRESS REPORT FOR MTR-ETR TECHNICAL BRANCHES, FIRST QUARTER, 1958. R. G. Fluhart, ed. Phillips Petroleum Co. Atomic Energy Div., Idaho Falls. IDO-16474  
NSA59-2551  
Calculations of the gamma-ray detection efficiencies of different shapes of NaI crystals and extended sources were completed.

205. QUARTERLY PROGRESS REPORT FOR PERIOD ENDING JUNE 15, 1950. Physics Div. Oak Ridge National Lab. ORNL-782

NSA51-618

Thallium-activated NaI gives very satisfactory performance as a phosphor, and gamma spectra have been obtained with it from a 330 day Cd,  $\text{Hg}^{203}$ ,  $\text{Cs}^{137}$ ,  $\text{Co}^{60}$ ,  $\text{K}^{42}$ ,  $\text{Na}^{24}$ ,  $\text{Cu}^{64}$ , and a Po-Be- $\text{B}_4\text{C}$  neutron source ( $\text{C}^{12}$  excited state at 4.4 Mev)

206. QUARTERLY PROGRESS REPORT NO. 51 FOR PERIOD ENDING OCTOBER 15, 1958. J. B. Wiesner et al. Mass. Inst. of Tech. Research Lab for Electronics. NP-7107

NSA59-5661

The three adiabatic constants of NaI were measured at 170 to 300°K by an ultrasonic pulse-echo technique.

207. QUENCHING OF NaI FLUORESCENCE BY  $\text{H}_2$ ,  $\text{HCl}$ ,  $\text{CO}_2$ , AND  $\text{H}_2\text{O}$ . H. G. Hanson. J. Chem. Phys. 23, No. 8, 1391-7 (Aug. 1955)

SA55-8634

208. RADIATION DAMAGE STUDIES IN SOLIDS: NUCLEAR RESONANCE ABSORPTION TECHNIQUE. Period covered Jan. 1, 1958 through Oct. 31, 1958. P. J. Bray. Brown Univ. NYO-7625

NSA59-8208

Experimental and theoretical studies of the preferential orientation of dislocations in single crystals of NaI and KI have progressed. Nuclear Magnetic Resonance studies of proton-irradiated (160 Mev) crystals of NaI and other alkali halides were started.

209. RADIATIONS OF CERTAIN SYNCHROTRON-INDUCED RADIO-ACTIVITIES. S. H. Cox, Jr. and L. J. Laslett. June, 1952. Ames Lab. ISC-276

NSA53-1000

The usefulness of scintillation-counter techniques in studies of synchrotron induced activities has been confirmed by this investigation. A method developed for preserving and mounting NaI, made the use of these crystals practical for gamma ray coincidence and energy measurements.

210. REDUCTION OF NaI BACKGROUND. C. E. Miller, L. D. Marinelli, R. E. Rowland, and J. E. Rose. Nucleonics 14, No. 4, 40-3 (1956) Apr.

NSA56-7894

Reduction of background counting rates of scintillation crystals.

211. REPRESENTATION OF OPTICAL CHARACTERISTICS OF ABSORBING MEDIA IN INFRARED REGION BY MEANS OF A RESONATOR MODEL WITH VISCOUS FRICTION. II. Alkali-halide crystals. L. D. Kislovskii. Optika i Spektroskopiya 2, 186-94 (1957)  
CA57-16074g
  
212. RESEARCH ON CRYSTAL DETECTORS OF IONIZING RADIATION: STUDIES AND APPLICATION OF SCINTILLATION COUNTERS. Third quarterly progress rept. R. Hofstadter, Princeton Univ. (nd) For Period ending: May 1, 1950. NP-1556  
NSA50-4986  
It was found that heretofore unknown resolution of gamma rays by NaI(Tl) can be achieved by using a single crystal. Studies have been made of the rate of decay of NaI(Tl) pulses as a function of temperature. Methods were developed showing that NaI(Tl) can be well preserved against moisture damage by enclosure in lucite.
  
213. RESOLUTION OF PHOTOMULTIPLIERS IN SCINTILLATION SPECTROMETERS. J. Kopecky and J. Kajfosz. Czechoslov. J. Phys. 8, 171-80 (1958) (In English)
  
214. RESPONSE CURVES OF ALKALI HALIDE SCINTILLATORS WITH SPECIAL REFERENCE TO THE  $\text{Li}^6(n, \alpha)$  REACTION IN LITHIUM IODIDE. T. R. Ophel (1958) Australian National Univ. Research School of Physical Sciences, Canberra. ANU/P-184.  
NSA58-12568
  
215. RESPONSE FUNCTION OF NaI(Tl) SCINTILLATION COUNTERS. M. J. Berger and J. Doggett. J. Research Natl. Bur. Standards 56, 355-66 (1956) Research Paper No. 2686.  
CA57-879h
  
216. RESPONSE FUNCTION OF NaI(Tl) SCINTILLATION COUNTERS. M. J. Berger and J. Doggett. Rev. Sci. Instr. 27, 269-70 (1956)  
CA57-17489c
  
217. RESPONSE FUNCTION OF THALLIUM-ACTIVATED SODIUM-IODIDE SCINTILLATION COUNTERS. See No. 215 above.
  
218. RESPONSE OF A LARGE SODIUM-IODIDE DETECTOR TO HIGH-ENERGY X-RAYS. J. H. Hubbell. Rev. Sci. Instr. 29, 65-8 (1958)
  
219. RESPONSE OF A SODIUM IODIDE SCINTILLATION COUNTER TO 18 Mev GAMMA RADIATION. J. G. Campbell and A. J. F. Boyle. Australian J. Phys. 7, 284-7 (1954)  
CA54-11205f

220. THE RESPONSE OF A NaI SCINTILLATION COUNTER TO SLOW AND FAST NEUTRONS. M. A. Grace et al. Proc. Phys. Soc. (London) A65, 456-7 (1952) June 1  
NSA52-4590
221. RESPONSE OF A SODIUM IODIDE SCINTILLATION SPECTROMETER TO 10- TO 20- Mev ELECTRONS AND X-RAYS. H. W. Koch and J. M. Wyckoff. J. Research Natl. Bur. Standards 56, 319-26 (1956) Research Paper No. 2682.  
CA57-845g
222. RESPONSE OF A NaI(Tl) CRYSTAL TO MONOERGIC NEUTRONS. S. M. Shafroth et al. Nuclear Instr. 3, 298-302 (1958)  
CA59-14746g
223. RESPONSE OF ACTIVATED INORGANIC SCINTILLATORS TO THE ENERGY RESPONSE OF INCIDENT RADIATIONS. A. Meessen. Ann. Soc. Sci. Bruxelles, Ser I, 69, 102-16 (1955)  
CA1956-7597e
224. RESPONSE OF CRYSTAL PHOSPHORS TO NUCLEAR RADIATION. Technical Note No. 1. L. Reiffel. June 4, 1957. AD-132384. Illinois Inst. of Tech. Armour Research Foundation. OSR-TN-57-313  
NSA57-12070
225. RESPONSE OF SODIUM IODIDE CRYSTALS TO ALPHA PARTICLES AND ELECTRONS AS A FUNCTION OF TEMPERATURE. E. der Mateosian et al. Phys. Rev. 101, 967-71 (1956) Feb. 1  
NSA56-5840
226. RESPONSE OF SODIUM IODIDE CRYSTALS TO HIGH ENERGY PROTONS. J. G. Likely and W. Franzen. Phys. Rev. 87, 666-7 (1952)  
CA52-10939h
227. RESPONSE OF NaI(Tl), KI(Tl), AND STILBENE TO FISSION FRAGMENTS. J. Milton and J. Fraser. Phys. Rev. 96, 1508-11 (1954) Dec. 15  
NSA55-1606
228. RESPONSE OF NaI(Tl) TO ENERGETIC HEAVY IONS. E. Newman and F. E. Steigert. Phys. Rev. 118, 1575-8 (1960) June 15  
NSA60-18290
229. RESPONSE OF NaI(Tl) TO SODIUM NUCLEI. E. N. Shipley et al. Rev. Sci. Instr. 30, 604-5 (1959)

230. RESPONSE OF SOME SCINTILLATION CRYSTALS TO CHARGED PARTICLES. C. J. Taylor et al. Phys. Rev. 84, 1034-43 (1951) Dec. 1  
NSA52-966
231. RESPONSE OF SOME SCINTILLATION CRYSTALS TO HEAVY PARTICLES. C. J. Taylor et al. Phys. Rev. 83, 169-70 (1951)  
CA51-8902h
232. RESPONSE OF "TOTAL ABSORPTION" SPECTROMETERS TO GAMMA RAYS. R. C. Davis et al. IRE Trans. on Nuclear Sci. NS-3, No. 4, 82-6 (1956)  
CA57-4832e
233. RESPONSE SPECTRA FOR GAMMA RAYS IN CsI. W. F. Miller and W. J. Snow. Rev. Sci. Instr. 31, 861-2 (1960) Aug.  
NSA60-23084  
Comparisons between the response spectra for CsI(Tl) and NaI(Tl) crystals of the same size are presented.
234. THE RESPONSE TO HIGH ENERGY GAMMA RAYS OF A NaI(Tl) SCINTILLATION SPECTROMETER. J. Kockum and N. Starfelt. Nuclear Instr. and Methods 4, 171-80 (1959) Apr.  
NSA59-14481
235. SCINTILLATING SOLUTIONS CONTAINING HEAVY ELEMENTS. H. P. Kallman et al. IRE Trans. on Nuclear Sci. NS-3, No. 4 51-6 (1956)  
CA57-4825d  
Experiments have been performed with inorg. salts, such as  $\text{Cu}(\text{NO}_3)_2$ ,  $\text{AgNO}_3$ , and NaI dissolved in a dioxane-water soln. Tables of the fluorescence of solns. contg. various metal salts are given.
236. SCINTILLATION AND OTHER RELATED PROPERTIES OF UN-ACTIVATED NaI CRYSTALS. Progress rept. for the period Jan 1, 1957 - Mar. 31, 1957. W. J. Van Sciver. Levinthal Electronic Products, Inc. AECU-3536.  
NSA57-11323
237. SCINTILLATION CONVERSION EFFICIENCY OF NaI(Tl) CRYSTALS. I. I. Lomonosov et al. Pribory i Tekh. Ekspt., No. 4, 70-1 (1959) July-Aug. (In Russian)  
NSA59-21112



238. SCINTILLATION COUNTER. S. Shimizu et al. Bull. Inst. Chem. Research, Kyoto Univ. 25, 54 (1951)

CA54-6851f

For measuring gamma ray energy and intensity, a scintillation counter was used with employment of transparent NaI and anthracene crystals prepd. by slow cooling method.

239. THE SCINTILLATION COUNTER AS A LOW-RESOLUTION GAMMA RAY SPECTROMETER. R. W. Pringle et al. Rev. Sci. Instruments 21, 216-18 (1950)

CA50-6733c

240. SCINTILLATION COUNTER FOR X-RAYS. G. Brogren and C. G. Rylander. Arkiv. Fysik 4, 495-9 (1952) (In English)

CA52-8981b

Scintillation counters with crystals of naphthalene, Ag activated ZnS, CdWO<sub>4</sub> and Tl-activated NaI were tested for their sensitivity to hard x-rays. The best results were obtained with Tl-activated NaI where an efficiency of 100% was recorded for all wave lengths even at normal background.

241. SCINTILLATION COUNTERS. W. W. Managan. Argonne National Lab. AECL-805. (Paper 5.10)

NSA60-5319

Thallium-activated sodium iodide, NaI(Tl), for gamma-ray and charged-particle spectrometry is described. Items described include a sandwich-type double crystal and ( $\Delta E.E$ ) product coincidence circuit for particle-mass and -charge discrimination in deuteron-scattering experiments, a gamma spectrometer using a 4 in. x 4 in. cylindrical NaI(Tl) crystal, the facilities for machining and packaging hygroscopic scintillators, and the current development status of sodium iodide scintillators.

242. SCINTILLATION COUNTERS FOR RADIOACTIVE SAMPLE MEASUREMENT. H. O. Anger. Rev. Sci. Instr. 22, 912-14 (1951)

CA52-4918i

Description of a counter using an NaI(Tl) crystal.

243. SCINTILLATION COUNTING: J. K. Bair. Mar. 16, 1951. NEPA Div. NEPA-1645.

NSA52-646

Techniques are given for the preparation of sodium iodide crystals.

244. SCINTILLATION COUNTING OF NATURAL URANIUM FOILS.  
R. C. Axtmann and J. S. Stutheit. Nucleonics 12, No. 7, 52-3 (1954)  
CA54-11205c  
Describes use of natural U foils for measurement of reactor neutron flux. Fission-product activation and  $U^{238}$  capture activation of U foils can be sepd. with a NaI(Tl) scintillation crystal spectrometer.
245. SCINTILLATION GAMMA SPECTROMETER. L. Pelekis. Trudy Inst. Fiz. Akad. Nauk Latv. S.S.R., Fiz. i Tekh. Primenen. Radioaktiv. Izotopov 9, 3-9 (1956)  
CA57-17489d  
Details are given for assembling a spectrometer for use with luminescent crystals of CsI(Tl) and NaI(Tl) followed by a photoelectronic multiplier, a preamplifier, and a radio-technical scheme for computing and analyzing the amplitude of the pulses.
246. SCINTILLATION MATERIALS AND METHODS OF MAKING SAME.  
(To Armour Research Foundation, U.S.A.) British Patent 792,071.  
Nuclear Eng. 3, 414 (1958) Sept.  
NSA58-17954  
It has been discovered that the scintillation characteristics of a single crystal scintillator can be closely approximated by an autogeneously banded polycrystalline compact made from a compacted mass of microcrystals of a host compound, permitting propagation of energy derived from nuclear radiation and an activator capable of fluorescence under the influence of such energy.
247. A SCINTILLATION PAIR SPECTROMETER. H. I. West, Jr. and L. G. Mann. Rev. Sci. Instr. 25, 129-135 (1954)  
CA54-8665d  
The spectrometer described involves the use of 3 NaI(Tl) crystals and has a high rejection of all unwanted pulses. The gamma rays pass into a center crystal and the pair events are selected by detecting the 2 annihilation quanta in the side crystals, along with coincidence circuits of 0.15 microsec. resolution.
248. SCINTILLATION PHENOMENA IN SODIUM IODIDE. W. J. Van Sciver and L. Bogart. IRE Trans. on Nuclear Sci. 5, 90-2 (1958)  
CA59-11018g
249. SCINTILLATION PHENOMENA IN NaI AND CsF (thesis).  
W. J. Van Sciver. Stanford Univ., Calif. High-Energy Physics Lab. Apr., 1955. HEPL-38  
NSA55-5109

250. THE SCINTILLATION RESPONSE FROM NaI(Tl) CRYSTALS UNDER BOMBARDMENT WITH POSITIVE IONS OF ENERGIES 60-600 kev. S. K. Allison and H. Casson. Phys. Rev. 90, 880-5 (1953) June 1  
NSA53-4189
251. SCINTILLATION RESPONSE OF ACTIVATED IONIC CRYSTALS TO CHARGED PARTICLES. A. Meyer and R. B. Murray. IRE Trans. Nuclear Sci. NS-7, No. 2-3, 22-5 (1960) June-Sept.  
NSA60-25688
252. SCINTILLATION RESPONSE OF PHOSPHORS AT LOW PARTICLE ENERGIES. G. T. Wright. Phys. Rev. 96, 569-70 (1954) Nov. 1  
NSA55-707
253. A SCINTILLATION SPECTROMETER. B. Astrom. Arkiv. Fysik 7, 241-5 (1953)  
CA54-10442f  
The design and performance of a scintillation spectrometer with NaI(Tl) crystals is described. A method of improving the overload characteristics of a linear amplifier and the circuit of a simple one-channel differential discriminator is given.
254. SCINTILLATION SPECTROMETER WITH AN ANTI-COINCIDENCE ANNULUS OF NaI(Tl). C. C. Trail and S. Raboy. Rev. Sci. Instr. 30, 425-9 (1959)
255. SCINTILLATION SPECTROMETERS FOR GAMMA-RADIATION. I. K. Jordan. Arch. tech. Messen No. 260, 193-6 (1957)  
CA58-2569e  
(See Item No. 270)
256. SCINTILLATION STUDIES OF ALKALI HALIDES. J. Bonanomi and J. Rossel. Helv. Phys. Acta, 24, 310-15 (1951)  
CA52-2414h  
The compounds studied were LiI, NaI, and KI, both as pure salts and activated with Tl. The measurements included the no. of scintillations per sec. as a function of temp. (100-200°K) after excitation with the 1.2 Mev gamma rays from Co<sup>60</sup>, the rise-time and amplitude of the charge produced in an electron multiplier, the decay of the luminescence, and the glow-curves observed.

257. SCINTILLATION THEORY. Nucleonics 18, No. 5, 86-7. May, 1960.  
SA60-13702

A review of several papers presented at the 1960 Scintillation Counter Symposium in Washington. The response of alkali halide crystals has been calculated using a model including the combination of hole-electron pairs into excitons, which diffuse and excite activators which then decay radiatively.

258. SCINTILLATION TYPE ION DETECTOR. P. I. Richards and E. E. Hays. Sept. 1949. AECU-678

NSA50-1748

A sensitive detector is described for use with a time of flight mass spectrometer to indicate the time of arrival of low energy ions. Three phosphors were studied; Ag activated ZnS, thallium activated NaI, and anthracene.

259. SCINTILLATIONS AND LUMINESCENCE IN UNACTIVATED SODIUM IODIDE. W. Van Sciver and R. Hofstadter. Phys. Rev. 97, 1181 (1955)

CA55-7402e

260. SCINTILLATOR GRID LOCALIZES GAMMA EMITTERS PHOTOGRAPHICALLY. C. Kellershohn and P. Pellerin. Nucleonics 13, No. 12, 34-7 (1955) Dec.

NSA56-1476

A system of NaI crystals set in a lead collimating grid has been designed which permits the "in vivo" localization of a radioactive body.

261. SEMICONDUCTOR ABSTRACTS. Battelle Memorial Institute. Vol. 1-, 1953- New York, Wiley.

Contains a section listing abstracts of articles pertaining to the luminescence of sodium halides.

262. SIMPLE EFFICIENT SHIELD FOR WELL-TYPE SCINTILLATION CRYSTALS. J. W. Irvine, Jr. Nucleonics 12, No. 10, 62-3 (1954)

263. A SIMPLE METHOD FOR THE ESTIMATION OF THE EFFICIENCY OF A NaI WELL-TYPE SCINTILLATOR. W. D. Schmidt-Ott. Z. Phys. 154, No. 3, 294-300 (1959) (In German)

SA59-9490

264. SLOW COMPONENT IN DECAY OF FLUORS. F. B. Harrison. Nucleonics 12, No. 3, 24-5 (1954)

CA54-6839c

NaI has one component with a decay time of 200 microsec. and something with a mean life of 1-13 sec., with 1.5% remaining after 1 sec.

265. A SLOW COMPONENT IN THE DECAY OF THE SCINTILLATION PHOSPHORS. J. A. Jackson and F. B. Harrison. Phys. Rev. 89, 322 (1953)

CA53-5256e

266. SODIUM IODIDE COUNTING RESPONSE FOR GAMMA RAYS. W. E. Kregar and L. McIsaac. Phys. Rev. 93, 943 (1954)

CA55-10042c

267. NaI SUMMING SPECTROMETER. P. Shapiro and R. W. Higgs. Rev. Sci. Instr. 28, 939-4 (1957)

A discussion on the analysis of pulse-height distributions obtained with gamma-ray sources placed inside well-type (Tl) NaI crystals.

268. SOME LINEARITY QUESTIONS IN SCINTILLATION SPECTROMETRY. Y. A. Nemilov et al. Izvest. Akad. Nauk. S.S.S.R. Ser. Fiz. 23, 257-62 (1959)

CA59-11018a

The dependence of line distortion and resolution in NaI(Tl) crystals is also briefly discussed.

269. SPECTRAL RELATION IN THE YIELD OF PHOTOLUMINESCENCE OF THALLIUM-ACTIVATED ALKALI IODIDES. Z. L. Morgenshtern. Doklady Akad. Nauk. S.S.S.R. 105, 250-2 (1955).

CA56-11826e

Relative yields of photoluminescence obtained with Tl-activated KI, NaI, and CsI monocrystals were measured as a function of wave length.

270. SPECTROMETRE A SCINTILLATIONS POUR RAYONNMENT GAMMA. (Scintillation spectrometer for gamma radiation, Part 1). K. Jordan. Translated into French from Arch. Tech. Messen, 260, 193-6 (1957) See Item No. 255

NSA59-16945

The absorption of gamma radiation in NaI crystals is described. Photoelectric effect, Compton effect, and pair formation and the frequency of these processes in sodium iodide crystals are discussed.

271. SPECTRUM AND DECAY OF NaI. W. J. Van Sciver. Nucleonics 14, No. 4, 50-1 (1956)

NSA56-7900

272. STUDIES ON THE LINEARITY OF A SCINTILLATION GAMMA-RAY SPECTROMETER. V. O. Eriksen and G. Jenssen. Phys. Rev. 85, 150 (1952) Jan. 1  
NSA52-2145
273. A STUDY OF PHOTONS IN SODIUM IODIDE SCINTILLATION CRYSTALS. C. M. Davisson and L. A. Beach. Sept. 15, 1959. Naval Research Lab., NRL-5408  
NSA60-12090
274. A STUDY OF PHOTONS IN NaI(Tl) SCINTILLATION COUNTERS. L. A. Beach and C. M. Davisson. p. 41-52 of proceedings of the ANP spectroscopy information meeting held August 6-7, 1957 at Wright Air Development Center. WADC-TN-57-298 (Pt. 1)  
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