

## RMD Publications 1980 to 1990

### 218) **HgI<sub>2</sub> low energy beta particle detector**

1990 IEEE Transactions on Nuclear Science Vol.37 Pages 152-154

Shah KS, Squillante MR, Entine G

#### *Abstract*

*An HgI<sub>2</sub> device structure was designed and tested which allows HgI<sub>2</sub> to be used to make low-energy beta-particle detectors. The devices detected tritium beta particles with an efficiency of about 25 percent. A protective encapsulant has been developed which should protect the devices for up to 20 years and will attenuate only a small fraction of the beta particles. It is noted that the devices hold significant promise to provide a practical alternative to liquid scintillation counters and gas flow-through proportional counters.*

### 217) **Boron phosphide on silicon for radiation detectors**

1990 Materials Research Society, Boston, MA Vol.162 Pages 601-604

Lund JC, Olschner F, Shah KS, Ahmed F

#### *Abstract*

*We report on radiation detectors fabricated from boron phosphide (BP) layers. These devices were fabricated by growing 1 to 10  $\mu$  m thick layers of BP by chemical vapor deposition (CVD) on (100) oriented n-type silicon substrates. Ohmic contacts were applied to the Si (Au--Sb). Schottky barrier contacts (also Au--Sb) were applied to the BP layer. The devices were tested as radiation detectors and were found to be capable of detecting individual 5.5 MeV alpha particles. With some improvements we hope to fabricate neutron detectors from these devices, making use of the very high cross-section of boron for thermal neutrons.*

### 216) **Gamma-induced coloring of doped heavy-metal fluoride glasses**

1990 Proceedings of SPIE - The International Society for Optical Engineering Vol.1327 Pages 107-129

de Rochemont LP, El Bayoumi OH, Suscavage MJ

#### *Abstract*

*Fluorozirconate glass compositions were irradiated with 1.173 and 1.333 MeV gamma-rays from a cobalt-60 source to study the influence which fluorine network concentrations, sodium doping, indium doping, cobalt doping, and cerium doping have on radiation damage. Lower concentrations of nonbridging fluorine ions were found to reduce color-center absorption and indium doping was found to eliminate visible and infrared radiation-induced colorization. (Author abstract) 26 Refs.*

### 215) **Nondestructive evaluation of reinforced plastics by a radiometric measurement technique**

1990 Proceedings of an American Nuclear Society Conference Vol.41 Pages 1117-1122

Entine G, Afshari S, Verlinden M

#### *Abstract*

*The demand for new high-performance plastics has greatly increased with advances in the performance characteristics of sophisticated reinforced engineering resins. However, conventional methods for the evaluation of the glass and filler contents of reinforced plastics are destructive, labor intensive, and time consuming. We have developed a new instrument, to address this problem, which provides for the rapid, accurate, and nondestructive measurement of glass or filler content in reinforced plastics. This instrument utilizes radiation transmission and scattering techniques for analytical measurement of glass, graphite and other fillers used in reinforced plastics.*

**214) Coal mining applications of CdTe gamma ray sensors**

1990 Applied Radiation and Isotopes Vol.41 Pages 1019-1021

Entine G, Tiernan T, Waer P, Hazlett T

*Abstract*

*Cadmium telluride (CdTe) solid-state radiation detectors have been used in the development of instrumentation that improves the efficiency of coal-mining operations by helping to locate coal seams and preventing the mining of high-sulfur coal near the edges of the seam. CdTe detectors were selected for these applications because while they are small and durable, they offer good stopping power, deliver adequate spectral response and operate at low voltage. These CdTe-base instruments have passed the mine-safety standards and are now in operation in the mine.*

**213) Charge carrier transport properties in thallium bromide crystals used as radiation detectors**

1990 IEEE Transactions on Nuclear Science Vol.37 Pages 1162-1164

Olschner F, Toledo-Quinones M, Shah KS, Lund JC

*Abstract*

*The authors report on measurements of the two most important transport parameters, the mobility  $\mu$  and the mean trapping time  $\tau$  for electrons and holes, in TlBr crystals prepared in the laboratory. The results using the transient charge technique are presented along with the data obtained by the pulse height spectrum analysis. The values of  $(\mu\tau)_{SUBe}$  and  $(\mu\tau)_{SUBh}$  measured for TlBr are still lower than those reported for more established detector materials such as CdTe and HgI<sub>2</sub>. It is noted, however, that purer TlBr exhibited somewhat improved transport characteristics, implying that  $\mu\tau$  may still be impurity-limited. For this reason, future improvements in purification will probably yield detectors having improved charge carrier transport. 11 Refs.*

**212) System for precise determination of effective atomic number by beta backscatter**

1990 IEEE Transactions on Nuclear Science Vol.37 Pages 230-233

Soller MS, Cirignano L, Lieberman P, Squillante MR

*Abstract*

*A compact instrument capable of determining the effective atomic number ( $Z_{SUBe}$ ) of a target has been developed and characterized. It is a nondestructive sensor which utilizes a cadmium telluride solid-state detector and a <sup>90</sup>Sr/<sup>90</sup>Y source in a backscatter geometry. The spectrum of the backscattered beta particles depends on the target atomic number. Measurements show that, by using the mean energy of the backscatter spectrum, the average effective atomic number can be determined to better than plus or minus 1Z. The system includes data acquisition and analysis software which runs on a personal computer. The system was designed to be flexible enough to be used for a variety of applications by changing the data analysis algorithms and the source type and energy.*

**211) Charge collection efficiency in a semiconductor radiation detector with a non-constant electric field**

1990 IEEE Transactions on Nuclear Science Vol.37 Pages 183-186

Shah KS, Lund JC, Olschner F

*Abstract*

*The development of a model which enables the calculation of charge collection efficiencies in a planar semiconductor detector with a nonconstant electric field is described. The validity of the model is verified analytically by comparing the results predicted by it with known solutions for the limiting case of a constant field. The correctness of the model is also established by comparing its predictions with experimental results. The utility of this model is shown by computing an electric field distribution which would lead to improved energy resolution in a semiconductor detector. 15 Refs.*

**210) HgISUB2 low energy beta particle detector**

1990 IEEE Transactions on Nuclear Science Vol.37 Pages 152-154

Shah KS, Squillante MR, Entine G

*Abstract*

*A HgISUB2 device structure was designed and tested which allows HgISUB2 to be used to make low energy beta particle detectors. The devices detected tritium beta particles with an efficiency of about 25%. A protective encapsulant has been developed which should protect the devices for up to 20 years and will attenuate only a small fraction of the beta particles. It is noted that the devices hold significant promise to provide a practical alternative to liquid scintillation counters and gas flow-through proportional counters. 6 Refs.*

**209) Large area silicon avalanche photodiodes for scintillation detectors**

1990 Nuclear Instruments & Methods in Physics Research, Section A: Accelerators, Spectrometers, Detectors and Associated Equipment Vol.288 Pages 137-139

Farrell R, Olschner F, Frederick E, McConchie L, Vanderpuye K, Squillante MR, Entine G

*Abstract*

*Large area (approximately equals 1 cm<sup>2</sup>) silicon avalanche photodiodes (SiAPDs) have been fabricated and their performance as optical detectors for use with scintillating crystals has been measured. Light sensitivity is measured for hexagonal SiAPDs of 1.57 cm<sup>2</sup> total package area, and the energy and timing resolution is measured for these devices coupled to CsI(Tl) scintillators operating as gamma spectrometers.*

**208) Stabilization of HgI2 X-ray detectors**

1990 Nuclear Instruments & Methods in Physics Research, Section A: Accelerators, Spectrometers, Detectors and Associated Equipment Vol.288 Pages 79-81

Squillante MR, Shah KS, Moy L

*Abstract*

*The principal problem limiting the use of HgI2 X-ray detectors is instability. We developed an encapsulation procedure potentially capable of stabilizing devices for 20 years. We also developed an accelerated test procedure to accurately simulate many years of aging.*

### 207) **Simulation of charge transport in semiconductor radiation detectors**

1990 Nuclear Instruments & Methods in Physics Research, Section A: Accelerators, Spectrometers, Detectors and Associated Equipment Vol.288 Pages 31-34

Lund JC, Olschner F

#### *Abstract*

*The performance of semiconductor radiation detectors is strongly influenced by the trapping and detrapping of electrons and holes in the semiconductor crystals used in their fabrication. Unfortunately, these effects are very difficult to predict analytically, even when assuming simple conditions such as constant electric field. We report on a technique which computes the induced current pulse as a function of time in semiconductor detectors using Monte Carlo methods. The charge collection efficiency may then be computed from the current pulse by integration. This technique uses a computer program which simulates the trapping and detrapping of individual charge carriers within a semiconductor detector under a broad range of conditions. For boundary conditions where analytical solutions exist, excellent agreement is obtained with the results of our simulation.*

### 206) **Device Measures Glass Distribution in Composites**

1990 Plast. World Vol.48 Page 25

Miller B

#### *Abstract*

*The ability to check glass distribution--one of the black holes in predicting the performance of structural composite parts--will be a welcome gift to processors from Compuglass, an analytical instrument that measures the glass content in reinforced materials nondestructively. A prototype system is being designed to scan automotive bumper beams for glass uniformity, but possible uses extend to any part whose performance depends on a controlled content of continuous, chopped or milled glass. Slurries and pellets, as well as parts, can be analyzed. Test time averages approx 2 min/point (or sample); results are accurate well within 1%.*

### 205) **Spray pyrolysis technique for the deposition of superconducting films**

1990 High-temperature superconductors: Fundamental properties and novel materials processing., Materials Research Society Symposium Vol.169 Pages 735-738

Soller M, Moy LP, Squillante MR, Marzik J, Christen D, Narayan J, Schneemeyer L

#### *Abstract*

*Research has been performed on the use of chemical spray pyrolysis for depositing films of YBCO. The effects of reagent concentration, deposition rate, substrate temperature and substrate type were investigated. Films from less than 2 to more than 10 microns thick were deposited on single crystal strontium titanate, polycrystalline alumina and type 304 stainless steel.*

### 204) **High resolution, low energy avalanche photodiode X-ray detectors**

1990 IEEE Nuclear Science Symposium Vol.1 Pages 219-222

Farrell R, Vanderpuye K, Entine G, Squillante MR

#### *Abstract*

*This paper reports that silicon avalanche photodiodes APDs have been fabricated and their performance as X-ray detectors has been measured. Photon sensitivity and energy resolution was measured as a function of size and operating parameters. Noise thresholds as low as 212 eV were obtained at room temperature and backscatter X-ray fluorescence data was obtained for aluminum and other light elements.*

**203) Boron phosphide on silicon for radiation detectors**

1990 Diamond, silicon carbide and related wide bandgap semiconductors., Materials Research Society Symposium Proceedings Vol.162 Pages 601-604

Lund JC, Olschner F, Shah KS, Ahmed F, Glass JT, Messier R, Fujimori N

*Abstract*

*The authors report on radiation detectors fabricated from boron phosphide (BP) layers. These devices were fabricated by growing 1 to 10  $\mu\text{m}$  thick layers of BP by chemical vapor deposition (CVD) on (100) oriented n-type silicon substrates. Ohmic contacts were applied to the Si (Au-Sb). Schottky barrier contacts (also Au-Sb) were applied to the BP layer. The devices were tested as radiation detectors and were found to be capable of detecting individual 5.5 MeV alpha particles. With some improvements the authors hope to fabricate neutron detectors from these devices, making use of the very high cross-section of boron for thermal neutrons.*

**202) Coal mining applications of CdTe gamma ray sensors**

1990 Applied Radiation and Isotopes Vol.41 Pages 1019-1021

Entine G, Tiernan T, Waer P, Hazlett T

*Abstract*

*Cadmium telluride (CdTe) solid-state radiation detectors have been used in the development of instrumentation that improves the efficiency of coal-mining operations by helping to locate coal seams and preventing the mining of high-sulfur coal near the edges of the seam. CdTe detectors were selected for these applications because while they are small and durable, they offer good stopping power, deliver adequate spectral response and operate at low voltage. These CdTe-based instruments have passed the mine-safety standards and are now in operation in the mine. (author).*

**201) Nondestructive evaluation of reinforced plastics by a radiometric measurement technique**

1990 Applied Radiation and Isotopes Vol.41 Pages 1117-1122

Entine G, Afshari S, Verlinden M

*Abstract*

*The demand for new high-performance plastics has greatly increased with advances in the performance characteristics of sophisticated reinforced engineering resins. However, conventional methods for the evaluation of the glass and filler contents of reinforced plastics are destructive, labor intensive, and time consuming. We have developed a new instrument, to address this problem, which provides for the rapid, accurate, and nondestructive measurement of glass or filler content in reinforced plastics. This instrument utilizes radiation transmission and scattering techniques for analytical measurement of glass, graphite and other fillers used in reinforced plastics.*

**200) HgI sub 2 low energy beta particle detector**

1990 IEEE Transactions on Nuclear Science Vol.37 Pages 152-154

Shah KS, Squillante MR, Entine G

*Abstract*

*This paper reports on a HgI sub 2 device structure designed and tested which allows HgI sub 2 to be used to make low energy beta particle detectors. The devices detected tritium beta particles with about a 25% efficiency. In addition, an encapsulation scheme was identified which has the potential to protect the devices while permitting most of the beta particles to reach the active region.*

**199) Charge collection efficiency in a semiconductor radiation detector with a non-constant electric field**

1990 IEEE Transactions on Nuclear Science Vol.37 Pages 183-186

Shah KS, Lund JC, Olschner F

*Abstract*

*The development of improved semiconductor radiation detectors would be facilitated by a quantitative model that predicts the performance of these detectors as a function of material characteristics and device operating parameters. An accurate prediction of the pulse height spectrum from a radiation detector can be made if both the noise and the charge collection properties of the detector are understood. The noise characteristics of semiconductor radiation detectors have been extensively studied. The effect of noise can be closely simulated by convoluting the noise-free pulse height spectrum with a Gaussian function. Distortion of semiconductor detector's pulse height spectrum from charge collection effects is more complex than the effects of noise and is more difficult to predict. To compute these distortions it is necessary to know how the charge collection efficiency  $\eta$  varies as a function of position within the detector  $x$ . These effects are shown. This problem has been previously solved for planar detectors with a constant electric field, for the case of spherical detectors, and for coaxial detectors. In this paper the authors describe a more general solution to the charge collection problem which includes the case of a non-constant electric field in a planar geometry.*

**198) A system for precise determination of effective atomic number by beta backscatter**

1990 IEEE Transactions on Nuclear Science Vol.37 Pages 230-233

Soller MS, Cirignano L, Lieberman P, Squillante MR

*Abstract*

*A compact instrument capable of determining the effective atomic number ( $Z_{\text{eff}}$ ) of a target has been developed and characterized. It is a non-destructive sensor which utilizes a cadmium telluride (CdTe) solid state detector and a  $^{90}\text{Sr}/^{90}\text{Y}$  source in a backscatter geometry. The spectrum of the backscattered beta particles depends on the target atomic number. Measurements show that by using the mean energy of the backscatter spectrum, the average effective atomic number can be determined to better than  $\pm 1 Z$ .*

**197) Charge carrier transport properties in thallium bromide crystals used as radiation detectors**

1990 IEEE Transactions on Nuclear Science Vol.37 Pages 1162-1164

Olschner F, Toledo-Quinones M, Shah KS, Lund JC

*Abstract*

*Thallium bromide (TlBr) is an attractive material for use in radiation detectors because of its wide bandgap (2.68 eV) and very high atomic number. Usefulness as a semiconductor detector material, however, also requires good charge carrier transport properties in order to maximize the magnitude of the signal from the detector. The authors report on measurements of the two most important transport parameters; the mobility  $\mu$  and the mean trapping time  $\tau$  for electrons and holes in TlBr crystals prepared in the laboratory.*

**196) Large area silicon avalanche photodiodes for scintillation detectors**

1990 Nucl. Instrum. Methods Phys. Res., Sect. A. Vol.288 Pages 137-139

Farrell R, Olschner F, Frederick E, McConchie L, Vanderpuye K, Squillante MR, Entine G

*Abstract*

*Large area ( approximately equals 1 cm<sup>2</sup>) silicon avalanche photodiodes (SiAPDs) have been fabricated and their performance as optical detectors for use with scintillating crystals has been measured. Light sensitivity is measured for hexagonal SiAPDs of 1.57 cm<sup>2</sup> total package area, and the energy and timing resolution is measured for these devices coupled to CsI (T1) scintillators operating as gamma spectrometers.*

**195) Stabilization of HgI<sub>2</sub> X-ray detectors**

1990 Nucl. Instrum. Methods Phys. Res., Sect. A. Vol.288 Pages 79-81

Squillante MR, Shah KS, Moy L

*Abstract*

*The principal problem limiting the use of HgI<sub>2</sub> X-ray detectors is instability. We developed an encapsulation procedure potentially capable of stabilizing devices for 20 years. We also developed an accelerated test procedure to accurately simulate many years of aging.*

**194) Simulation of charge transport in semiconductor radiation detectors**

1990 Nucl. Instrum. Methods Phys. Res., Sect. A. Vol.288 Pages 31-34

Lund JC, Olschner F

*Abstract*

*The performance of semiconductor radiation detectors is strongly influenced by the trapping and detrapping of electrons and holes in the semiconductor crystals used in their fabrication. Unfortunately, these effects are very difficult to predict analytically, even when assuming simple conditions such as constant electric field. We report on a technique which computes the induced current pulse as a function of time in semiconductor detectors using Monte Carlo methods. The charge collection efficiency may then be computed from the current pulse by integration. This technique uses a computer program which simulates the trapping and detrapping of individual charge carriers within a semiconductor detector under a broad range of conditions. For boundary conditions where analytical solutions exist, excellent agreement is obtained with the results of our simulation.*

**193) A real-time imaging system for rapid processing of radioactive DNA samples**

1990 Nucl. Instrum. Methods Phys. Res., Sect. A. Vol.299 Pages 511-515

McGann WJ, McConchie L, Entine G

*Abstract*

*A new, high-resolution nuclear-imaging detector system is described which substantially improves the speed of detection of radioactively labeled DNA samples. Ultimately this system will be made compatible with a fully automated DNA processing system to aid in the isolation and harvesting of DNA clones in the human genome.*

**192) A new solid-state detector for radiation-therapy imaging**

1990 Nucl. Instrum. Methods Phys. Res., Sect. A. Vol.299 Pages 172-175

McGann WJ, Cirignano L, Entine G, Biggs P

*Abstract*

*A new approach to imaging the high-intensity photon flux from medical linear accelerators is described. Photovoltaic diodes made from cadmium telluride were used to generate high-contrast images in a 10 MV radiation-therapy treatment accelerator. A linear scanning array of these diodes will be capable of generating images over an area of 40x40 cm<sup>2</sup> in under 5 s, a factor of 8 times faster than the current silicon-diode system. (orig.).*

**191) A triple sector mass spectrometer for large cluster chemistry**

1990 Gordon Conf. On Atomic and Molecular Interactions, Newport, RI Vol. July 29-Aug. 3

Christian JF, Wan Z, Anderson SL

**190) A multileaf collimator for high energy linac**

1990 MLC Supplementary Information Vol. Jan. 30 Pages 1-2

Biggs P, Entine G, Sharif D, Hahn R

**189) Process characterization of barium calcium copper oxide: Precursor films of high temperature superconductors prepared by spray pyrolysis.**

1990 Fall Meeting of Materials Research Soc., Boston Vol.

DeRouchemont LP, Zhang J, Squillante MR

**188) Non-destructive evaluation of reinforced plastics by a radiometric measurement technique**

1990 Appl Rad Vol. 41 Pages 1117-1122

Entine G, Afshair S, Verlinden M

**187) TI-based high temperature superconducting thin films**

1990 Proc Sec Intl Symp on Supercond and Related Character in Layered Compounds, Tokyo, Japan Vol. Dec. 8

Hermann AM, Duan HM, Kuwahara H, de Rochemont LP, Squillante MR

**186) Simulation of charge transport in semiconductor radiation detectors**

1990 Nucl Instr Methods in Phys Res Vol. A288 Pages 31-34

Lund J, Olschner F

**185) A real time imaging system for rapid processing of radioactive DNA samples**

1990 Nucl Instr Methods in Phys Res Vol. A272 Pages 511-515

McGann WJ, McConchie L, Entine G

**184) Xenon kinetics in muscle are not explained by a model of parallel perfusion-limited compartments**

1990 J Appl Physiol Vol. 68 Pages 876-890

Novotny JA, Mayers DL, Parsons YFJ, Survanshi SS, Weathersby PK, Homer LD

**183) Characterization of thallium bromide nuclear detectors**

1990 Nucl Instr Methods Phys Res Vol. A299 Pages 57-59

Shah KS, Olschner F, Moy LP, Lund JC, Squillante MR

## 182) The evaluation of a gastric bile probe

1990 Nucl Med Commun Vol.11 Pages 777-790

Stoker DL, Williams JG, MacLead MA, Colin-Jones DG

### *Abstract*

*The purpose of this study was to validate a new technique for measuring duodenogastric bile reflux in the human subject. A custom built cadmium telluride gamma detector (Radiation Monitoring Devices, MA), small enough to be passed into the esophagus and stomach, was developed and tested for sensitivity to  $^{99}\text{Tcm}$  and  $^{75}\text{Se}$  radioisotopes. When immersed in radiolabeled water, the detector was capable of measuring gamma radiation in quantities as low as 0.1 microCi (0.0037 MBq) per ml. Two patients (A and B) with endoscopically proven bile reflux, and three normal volunteers (C, D and E) underwent esophageal manometry to map the position of the lower esophageal sphincter (LOS). The gamma probe was passed via the nose, to a position in the gastric fundus, 5 cm below the LOS. The gamma probe was passed via the nose, to a position in the gastric fundus, 5 cm below the LOS. Each subject was placed supine under a gamma camera (Siemens LFOV 37 ZLC head), centered on the epigastrium. A 4 mCi (148 MBq) dose of radiolabelled  $^{99}\text{Tcm}$ -HIDA was administered intravenously, and simultaneous internal/external scanning was performed for between 45 and 90 min. Internal gamma probe data was transferred by a screened cable to a Memolog 600 portable recorder, using a 5 s counting interval, and from the gamma camera to a Nodecrest Micas III computer, using a 15 s counting interval. Gamma camera counts from a region of interest over the fundus of the stomach were then correlated with counts from the internal probe using a linear regression analysis program on the Nodecrest. The internal gamma probe functioned well at body temperature in the acidic gastric environment. Radiolabeled bile refluxed into the stomach during HIDA scanning in three out of the five subjects (one patient and two normal volunteers). There was a strong correlation between internal and external gamma counts (A,  $r = +0.79$ ; C,  $r = +0.53$ ; E,  $r = +0.54$ ;  $p$  greater than 0.01). In the other two cases, there was no bile reflux, but still a significant correlation between internal and external gamma counts (B,  $r = +0.89$ ; D,  $r = 0.75$ ;  $p$  greater than 0.01). The mean correlation coefficient for the series of five cases was +0.70. We conclude firstly that the newly developed internal gamma detector is capable of measuring the reflux of radiolabeled bile into the human stomach and, secondly, that bile reflux may occur in normal subjects as well as those with upper gastrointestinal pathology.*

## 181) Development of two new M- pi -n CdTe sensors

1989 Nuclear Instruments & Methods in Physics Research, Section A: Accelerators, Spectrometers, Detectors and Associated Equipment Vol.283 Pages 323-329

Squillante MR, Entine G, Frederick E, Cirignano L, Hazlett T

### *Abstract*

*Recent research on the M- pi -n CdTe device structure has resulted in the development of two new CdTe nuclear sensors. One of these operates at much higher biases than standard CdTe devices and exhibits good energy resolution and fast response. The other operates in the photovoltaic mode and requires no applied bias. It operates over a wide dynamic range and can measure radiation fluxes as high as 10-12 photons  $\text{cm}^{-2} \text{min}^{-1}$ . These two new sensors should significantly increase the range of applications for CdTe nuclear sensors.*

### 180) **Properties of lead iodide semiconductor radiation detectors**

1989 Nuclear Instruments & Methods in Physics Research, Section A: Accelerators, Spectrometers, Detectors and Associated Equipment Vol.283 Pages 299-302

Lund JC, Shah KS, Squillante MR, Moy LP, Sinclair F, Entine G

#### *Abstract*

*Semiconductor radiation detectors have been fabricated from melt grown crystals of lead iodide (PbI<sub>2</sub>) and the performance of these detectors as room temperature X-ray spectrometers has been measured. These detectors exhibit good energy resolution (915 eV FWHM for the 5.9 keV peak of <sup>55</sup>Fe at 20 degree C). Preliminary results indicate they are more stable than HgI<sub>2</sub> detectors and capable of operating at temperatures over 100 degree C.*

### 179) **Survey of CdTe nuclear detector applications**

1989 Nuclear Instruments & Methods in Physics Research, Section A: Accelerators, Spectrometers, Detectors and Associated Equipment Vol.283 Pages 282-290

Entine G, Waer P, Tiernan T, Squillante MR

#### *Abstract*

*Research and development efforts on CdTe have been ongoing for many years. The improved sensor performance which has resulted from these efforts has increased the number of critical applications for which CdTe sensors are the best choice. Applications range from clinical diagnosis and life saving monitoring systems in nuclear medicine to quality assurance systems in manufacturing and safety systems in the nuclear power industry. New applications for CdTe have been increasing rapidly over the last few years and several of the most important are discussed.*

### 178) **QC Analysis of Glass and Filler Levels**

1989 Plast. Compd. Vol.12 Pages 31-32

Afshari S, Verlinden M

#### *Abstract*

*Until recently, no rapid nondestructive test has been able to determine the fractional content of reinforcing fiber, fillers, or fire retardants in composites for either online process control or quality assurance of finished components. The industry has relied either on wet-chemical techniques, in which the samples are chemically ingested, or on ash tests, in which the samples are burned. These standard techniques, aside from completely destroying the sample, are time consuming and labor intensive. Furthermore, the results may be misleading or incorrect, since the tested samples are a very small fraction of the product and may not be representative of the whole. Analyzing samples of less than a few grams presents a large potential for relative error. An instrument is now available, however, that makes possible the rapid, accurate, simple, and real-time nondestructive analysis of reinforced plastics. The Compuglass Analyzer employs nondestructive radiation techniques to measure glass and filler contents. The measurements are based on radiation-transmission gauging techniques and the relative-absorption characteristics of materials for specific radiation types and energies.*

### 177) **QC ANALYSIS OF GLASS AND FILLER LEVELS**

1989 Plastic Compounding Vol.12 Pages 31-37

Afshari S, Verlinden M

#### *Abstract*

*The Compuglass Analyzer employs non-destructive radiation transmission techniques to measure glass and filler contents in thermoplastics, thermosetting resin pellets, slurries and moulded parts. The equipment uses a low-energy radiation source and advanced detector assemblies with adequate shielding and protection. The operation of the equipment is described and accuracy measurements are reported.*

#### 176) **Thallium bromide radiation detectors**

1989 Transactions on Nuclear Science Vol.36 Pages 199-202

Shah KS, Lund JC, Olschner F, Moy L, Squillante MR

##### *Abstract*

*Crystals of highly purified thallium bromide were used to fabricate radiation detectors. These detectors were tested with isotopic photon sources and successfully detected gamma and X-rays in the 0.01- to 1- MeV energy range. The detectors were tested at and below room temperature, and their performance approaches that of other semiconductor detector materials which have been under development. The performance of TlBr detectors is due to the similarity in the transport characteristics of electrons and holes in TlBr and the relatively large number of charge carriers produced per unit of energy of detected particle. The performance of these detectors is currently limited by shot noise induced by the leakage current in the TlBr.*

#### 175) **Indium phosphide particle detectors**

1989 Trans. Nucl. Sci. Vol.36 Pages 210-212

Olschner F, Lund JC, Squillante MR, Kelly DL

##### *Abstract*

*Little work has been done adapting the III-IV compound indium phosphide (InP) for use in semiconducting particle detectors, although InP has been mentioned as a material of interest. This interest is due to the relatively high atomic number, large bandgap (1.35 eV), and the large electron and hole mobilities achievable in InP. It has also been pointed out that the  $^{115}\text{In}$  has a large cross section for solar neutrino interaction and a solar neutrino (128 keV threshold) detector could possibly be built from an array of indium containing detectors. In this article, the authors report on semiconductor particle detectors fabricated from InP and tested under various conditions.*

#### 174) **Monte carlo simulation of gamma ray spectra from semiconductor detectors**

1989 Trans. Nucl. Sci. Vol.36 Pages 1176-1181

Olschner F, Lund JC, Stern I

##### *Abstract*

*Although the physical effects occurring within semiconductor gamma ray detectors are separately well understood, it is not always clear exactly how the effects combine to create the sometimes complicated gamma ray pulse height spectra measured in the laboratory. A useful tool to study this is a computerized simulation of the gamma ray detector. In such simulations various physical effects can be turned on or off allowing the effects to be studied separately. Reliable simulation algorithms can be used to optimize a detector geometry or configuration, significantly reducing the experimental effort usually associated with detector development. Pulse height spectrum simulations can also be useful in the creation of detector response matrices. These matrices are necessary to reconstruct actual energy spectra from the measured energy spectra. Although other methods have been used, the authors chose to use a Monte Carlo type algorithm to simulate detector performance. Monte Carlo is well suited to simulate the natural stochastic processes in gamma ray interactions.*

**173) Survey of CdTe nuclear detector applications**

1989 Nucl. Instrum. Methods Phys. Res., Sect. A. Vol.283 Pages 282-290

Entine G, Waer P, Tiernan T, Squillante MR

*Abstract*

*Research and development efforts on CdTe have been ongoing for many years. The improved sensor performance which has resulted from these efforts has increased the number of critical applications for which CdTe sensors are the best choice. Applications range from clinical diagnosis and life saving monitoring systems in nuclear medicine to quality assurance systems in manufacturing and safety systems in the nuclear power industry. New applications for CdTe have been increasing rapidly over the last few years and several of the most important are discussed. (orig.).*

**172) Development of two new M- pi -n CdTe sensors**

1989 Nucl. Instrum. Methods Phys. Res., Sect. A. Vol.283 Pages 323-329

Squillante MR, Entine G, Frederick E, Cirignano L, Hazlett T

*Abstract*

*Recent research on the M- pi -n CdTe device structure has resulted in the development of two new CdTe nuclear sensors. One of these operates at much higher biases than standard CdTe devices and exhibits good energy resolution and fast response. The other operates in the photovoltaic mode and requires no applied bias. It operates over a wide dynamic range and can measure radiation fluxes as high as  $10^{12}$  photons  $cm^{-2} s^{-1}$ . These two new sensors should significantly increase the range of applications for CdTe nuclear sensors. (orig.).*

**171) Properties of lead iodide semiconductor radiation detectors**

1989 Nucl. Instrum. Methods Phys. Res., Sect. A. Vol.283 Pages 299-302

Lund JC, Shah KS, Squillante MR, Moy LP, Sinclair F, Entine G

*Abstract*

*Semiconductor radiation detectors have been fabricated from melt grown crystals of lead iodide ( $PbI_2$ ) and the performance of these detectors as room temperature X-ray spectrometers has been measured. These detectors exhibit good energy resolution (915 eV FWHM for the 5.9 keV peak of  $^{55}Fe$  at 20deg C). Preliminary results indicate they are more stable than  $HgI_2$  detectors and capable of operating at temperatures over 100deg C. (orig.).*

**170) An evaluation of two probe systems for the intraoperative detection of  $^{111}In$ -labeled monoclonal antibodies (Mab's) against gastrointestinal cancer**

1989 J Nucl Med Vol.30 Page 891

Davidson BR

**169) Intra-operative localization of colorectal cancers and their metastases with a radiation detecting probe**

1989 GUT Vol.30 Page A713

Davidson BR, Waddington WA, Short MD, Boulos PB

**168) Brain tumor metabolism and blood flow studies using rat ear pouch and miniature CdTe beta detector**

1989 Brain Tumor Metabolism and Blood Flow Studies Using Rat Ear Pouch and Miniature CdTe Beta Detector Vol. Brain Conference, Bologna, Italy

DiResta GR, Arbit E, Entine G, Dahl JR, Chaly T, Alfieri A, Lau N, Bading JR

**167) A surgical imaging probe for tumor detection**

1989 J Nucl Med Vol.30 Page 891

Hartsough NE, Barber HB, Barrett HH, Woolfenden FM

**166) Measurement of cerebral blood flow with a noninvasive Xenon-133 method in preterm infants.**

1989 Physiol Found Prenatal Care Vol.3 Pages 231-242

Jaggi JL, Lipp AE, Duc G

**165) An inexpensive miniaturized linear CdTe detector array system**

1989 Health Physics Vol.57 Pages 825-830

Kearfott KJ, Murray D

**164) High resistive float zone silicon wafers for silicon detector applications**

1989 IEEE Trans Nucl Sci Vol.NS-36 Pages 290-292

Li Z, Kraner HW

**163) Oxygen affinity of hemoglobin modulates cerebral blood flow in premature infants**

1989 Acta Pediatr Scan (Suppl) Vol.360 Pages 26-32

Lipp-Zwahlen AE, Muller A, Tuchschnid P, Duc G

**162) Physiology of Rcbf in premature infants during the first 26 hours**

1989 J Cerebral Blood Flow Metabol (Suppl 1) Vol.9 Page S701

Lipp AE, Muller A, Duc G

**161) New semiconductor materials for radiation detectors**

1989 ICFA Instrumentation Bull Vol.7 Pages 9-15

Olschner F, Lund JC, Shah KS, Squillante MR

**160) INTRA-OPERATIVE REGIONAL MYOCARDIAL BLOOD FLOW MONITOR**

1988 J NUCL MED Vol.29 Page 880

Tiernan T, Entine G, Stump DA, Prough DS

**159) Solid-state nuclear detectors for monitoring low levels of tritium**

1988 Fusion Technology Vol.14 Pages 1041-1046

McGann WJ, Entine G, Farrell RF, Clapp A, Squillante MR

*Abstract*

*Low noise silicon avalanche photodiodes (APDs) with ultra thin surface dead layers have been developed for detecting tritium beta particles. Unlike the present windowless proportional counters and liquid scintillation techniques this alternative requires no liquid or flowing gases and has the reliability and compactness of solid-state detector technology. The authors have carried out detector research to study and optimize the physical and electrical properties of APDs for nuclear spectroscopy. A particular emphasis has been placed on reducing the noise and surface dead layer of large area avalanche photodiodes (1 cm diameter) in order to maximize the quantum efficiency for detecting low energy betas, as well as to investigate the effects of changing temperature, bias, and leakage current on avalanche gain, signal-to-noise and tritium detection quantum efficiency.*

**158) Portable real time analysis system for regional cerebral blood flow**

1988 IEEE Transactions on Nuclear Science Vol.35 Pages 698-702

Tiernan T, Entine G, Stump DA, Prough DS

*Abstract*

*A portable, regional cerebral blood flow (rCBF) analysis instrument system suitable for use in the operating theater during surgery is under development. Cadmium telluride (CdTe) solid-state radiation detectors, an 8086-based data acquisition and communication module, and a DEC Microvax computer are used, so that the instrument is very compact yet has the computational power to provide real-time data analysis in the clinical environment. The instrument is currently being used to study rCBF during cardiopulmonary bypass surgery. Preliminary studies indicate that monitoring rCBF during this surgical procedure can provide insights into the mechanism that causes a significant fraction of these patients to suffer postoperative neuropsychological deficit.*

**157) Energy compensated solid state gamma dosimeter**

1988 IEEE Transactions on Nuclear Science Vol.35 Pages 562-566

Sinclair F, Clapp A, Entine G, Kronenberg S

*Abstract*

*An analytical model of the detector response for a p-i-n diode has been developed and tested with monoenergetic isotopic sources. The model was then used to simulate the detector response over a wide range of photon energies. This matrix was used in turn to calculate a pulse-height correction factor. Irradiation of the device in a variable-energy X-ray beam showed that while there are some fundamental limitations, this approach can improve the accuracy of the measurement of the dose delivered to tissue.*

**156) Indium phosphide particle detectors for low energy solar neutrino spectroscopy**

1988 Nuclear Instruments & Methods in Physics Research, Section A: Accelerators, Spectrometers, Detectors and Associated Equipment Vol.272 Pages 885-888

Lund JC, Olschner F, Sinclair F, Squillante MR

*Abstract*

*Semiconductor radiation detectors have been constructed from indium phosphide to investigate the feasibility of using them in a solar neutrino detector. The  $^{51}\text{In}$  (76% by mass) in an InP detector is expected to undergo the reverse beta decay reaction induced by the solar neutrino flux. This reaction produces energetic photons and electrons which might be used to identify and measure the energy of low energy neutrinos. InP detectors up to 1.0 cm<sup>3</sup> in volume capable of detecting individual electrons and photons have been constructed.*

**155) Solid-state nuclear detectors for monitoring low levels of tritium**

1988 Fusion Technology Vol.14 Pages 1041-1046

McGann WJ, Entine G, Farrell RF, Clapp A, Squillante MR

*Abstract*

*Low noise silicon avalanche photodiodes (APDs) with ultra thin surface dead layers have been developed for detecting tritium beta particles. Unlike the present windowless proportional counters and liquid scintillation techniques this alternative requires no liquid or flowing gases and has the reliability and compactness of solid-state detector technology. We have carried out detector research to study and optimize the physical and electrical properties of APDs for nuclear spectroscopy. A particular emphasis has been placed on reducing the noise and surface dead layer of large area avalanche photodiodes (1 cm diameter) in order to maximize the quantum efficiency for detecting low energy betas, as well as to investigate the effects of changing temperature, bias, and leakage current on avalanche gain, signal-to-noise and tritium detection quantum efficiency.*

**154) Indium phosphide particle detectors for low energy solar neutrino spectroscopy**

1988 Nucl. Instrum. Methods Phys. Res. Vol.272 Pages 885-888

Lund JC, Olschner F, Sinclair F, Squillante MR

*Abstract*

*Semiconductor radiation detectors have been constructed from indium phosphide to investigate the feasibility of using them in a solar neutrino detector. The  $^{115}\text{In}$  (76% by mass) in an InP detector is expected to undergo the reverse beta decay reaction induced by the solar neutrino flux. This reaction produces energetic photons and electrons which might be used to identify and measure the energy of low energy neutrinos. InP detectors up to  $1.0\text{ cm}^3$  in volume capable of detecting individual electrons and photons have been constructed.*

**153) Performance of a 6 mm thick CdTe detector for 166 keV gamma rays**

1988 Nucl. Instrum. Methods Phys. Res. Vol.272 Pages 825-833

McKee BTA, Goetz T, Hazlett T, Forkert L

*Abstract*

*In order to extend the utility of CdTe detectors to higher gamma ray energies, yet avoid increasing the charge collection problems of thick detectors, a 6 mm thick detector configuration has been developed consisting of three crystals 2 mm thick and of 16 mm diameter. The active volume is over  $1.0\text{ cm}^3$ . The performance of this detector has been evaluated for gamma rays of 166 keV energy by measuring the pulse height spectra and determining the intrinsic peak and total efficiencies over a range of bias voltages and amplifier time constants. A maximum peak and total efficiency of 41% and 80% were obtained with 200 V bias and 2  $\mu\text{s}$  amplifier time constant, although under these conditions the noise width was almost 40 keV FWHM. A Monte Carlo model was used to simulate the gamma ray and electron interaction in this 6 mm detector. Charge collection, including trapping effects, was incorporated into the model. The model pulse height spectra could be approximately matched to the measured data using hole and electron effective mobility values of 60 and 600  $\text{cm}^2/\text{V s}$ , and hole and electron mean trapping times of 25 and 15  $\mu\text{s}$ . Our findings indicate that detectors such as this will not be useful for high resolution spectroscopic applications, but the high gamma ray stopping power will be of interest for applications where the noise width is acceptable. Results from the modeling imply that in this detector shallow trapping sites (reducing the effective mobility) are more important than deep trapping sites in contributing to incomplete charge collection.*

**152) Lead iodide nuclear spectrometers**

1988 IEEE Trans. Nucl. Sci. Vol.35 Pages 89-92

Lund JC, Shah KS, Squillante MR, Sinclair F

*Abstract*

*This paper discusses the preparation of radiation detectors from the semiconductor lead iodide,  $PbI_2$ , and evaluates the performance of these devices as x-ray and gamma ray spectrometers. It was found that lead iodide detectors prepared from melt grown crystals exhibited good energy resolution for low energy ( $<10$  keV) x-rays. The energy resolution for higher energy photons was less, consistent with the measured values of the electron and hole mobility-lifetime products. The performance of the  $PbI_2$  detectors at elevated temperatures was also measured and it was found that the detectors continued to operate well at temperatures over 100 sup 0 C.*

**151) Portable real time analysis system for regional cerebral blood flow**

1988 IEEE Trans. Nucl. Sci. Vol.35 Pages 698-702

Tiernan T, Entine G, Stump DA, Prough DS

*Abstract*

*A very portable, regional cerebral blood flow (rCBF) analysis instrument system suitable for use in the operating theater during surgery is under development. Cadmium telluride (CdTe) solid state radiation detectors, an 8086 based data acquisition and communications module and a DEC Microvax computer are used so that the instrument is very compact, yet has the computational power to provide real time data analysis in the clinical environment. The instrument is currently being used at Bowman Gray School of Medicine to study rCBF during cardiopulmonary bypass surgery (CPB). Preliminary studies indicate that monitoring rCBF during this surgical procedure may provide insights into the mechanism that causes a significant fraction of these patients to suffer post operative neuropsychological deficit.*

**150) A perspective on periodontal disease activity measurements**

1988 J Clin Periodontal Res Vol.15 Pages 134-136

Hausman E, Jeffcoat M

**149) Flurbiprofen treatment of human periodontiti: Effect on alveolar bone height and metabolism**

1988 J Periodontal Res Vol.23 Pages 381-385

Jeffcoat MK, Williams RC, Reddy MS, English R, Goldhaber P

**148) Comparison of NaI, CdTe, HgI<sub>2</sub> surgical probes in a numerical torso phantom (Abstract)**

1988 Soc Nucl Med, San Francisco Vol.June 14-17

Kwo DP, Barber HB, Barrett HH, Hickernell TS, Woolfenden JM, Ortale C, Entine G

**147) Indium phosphide neutrino detectors**

1988 Proc. 13th Intl. Conf. Neutrino Phys and Astrophys, Boston. Eds: Schneps J, Kafka T, et al. Vol.June 5-11

Olschner F, Lund JC, Squillante MR, Sinclair F

**146) The duration of cardiopulmonary bypass is a factor in the decline of cerebral blood flow**

1988 J Cardiovasc Ultrasonography Vol.7

Sumpt DA, Rogers AT, Prough DS, Gravell GP, Phipps JM, Wallenhaupt S, Entine G.

**145) Portable, solid-state real-time instrument for space dosimetry.**

1988 Presented to the Health Phys. Soc. Ann. Meeting, Boston, MA Vol. July 4-8

Tiernan T, Nagarkar V, Entine G, Lieberman P, Hardy KA.

**144) Nondestructive Measurement of Glass Content in Composites**

1987 Compos. Adhes. Newsl. Vol.3 Page 13

*Abstract*

*Available from Radiation Monitoring Devices, Inc., 44 Hunt St., Watertown, Massachusetts 02172, USA, Compuglass is based on transmission of radiation through the material. Instrument is calibrated with samples of known composition, and can then be used in "the assay of unknown samples". Good agreement was found with conventional destructive methods. Measurements require 2 min or less/sample. (News Brief).*

**143) PORTABLE REAL TIME ANALYSIS SYSTEM FOR REGIONAL CEREBRAL BLOOD FLOW**

1987 IEEE Transactions on Nuclear Science Vol.35 Pages 698-702

Tiernan T, Entine G, Stump DA, Prough DS

*Abstract*

*A portable, regional cerebral blood flow (rCBF) analysis instrument system suitable for use in the operating theater during surgery is under development. Cadmium telluride (CdTe) solid-state radiation detectors, an 8086-based data acquisition and communication module, and a DEC Microvax computer are used, so that the instrument is very compact yet has the computational power to provide real-time data analysis in the clinical environment. The instrument is currently being used to study rCBF during cardiopulmonary bypass surgery. Preliminary studies indicate that monitoring rCBF during this surgical procedure can provide insights into the mechanism that causes a significant fraction of these patients to suffer postoperative neuropsychological deficit.*

**142) LEAD IODIDE NUCLEAR SPECTROMETERS**

1987 IEEE Transactions on Nuclear Science Vol.35 Pages 89-92

Lund JC, Shah KS, Squillante MR, Sinclair F

*Abstract*

*The preparation of radiation detectors from semiconducting lead iodide is discussed, and the performance of these devices as X-ray and gamma-ray spectrometers is evaluated. Detectors prepared from melt-grown crystals exhibit good energy resolution for low-energy (less than 10 keV) X-rays. The energy resolution for higher-energy photons is lower, consistent with the measured values of the electron and hole mobility-lifetime products. Measurements at elevated temperatures show that the detectors continue to operate well over 100 degree C. 9 refs.*

**141) MASS TRANSFER OF CARBON DIOXIDE THROUGH CATHETERS OF AN IMPLANTABLE DRUG DELIVERY SYSTEM**

1987 American Institute of Chemical Engineers, National Meeting, Minneapolis, MN Vol. Aug. 6-16

Shah KS, Donatelli AA

*Abstract*

*This work, which focused on an implantable catheter system that could be used for administering drugs, was concerned with the diffusion of carbon dioxide from body fluids and tissue into the therapeutic solutions. A model was developed for predicting the rate of COSUB2 transfer from the body fluids and tissue, through the catheter wall and into an aqueous drug solution where it was subsequently absorbed. A variety of catheters, including multilayered systems, were analyzed, and the mass transfer behavior was characterized in terms of a wall Sherwood number. An experimental program was performed to examine a variety of polymeric materials and catheter configurations with respect to COSUB2 transport and also to verify the model. The rate of COSUB2 permeation increased with the wall Sherwood number as expected, and excellent agreement was obtained between the theoretical predictions and experimental results. (Edited author abstract) 13 refs.*

**140) Properties of a new CdTe detector for nuclear medicine**

1987 IEEE Trans. Nucl. Sci. Vol. NS-34 Pages 354-358

Frederick E, Clapp A, Entine G, Hazlett T, Lund JC, Sinclair F, Squillante MR

*Abstract*

*A CdTe device structure was investigated for suitability in nuclear medicine instrumentation. These new detectors are room temperature, gamma -ray sensors which have good charge collection and response times of 10-20 ns. Devices 0.8 mm to 5 mm thick have been characterized with regard to energy resolution and coincidence time interval resolution.*

**139) The application of radiation sensors to reinforced composite analysis.**

1987 Presented to the Sensors Expo, NDE of Plastics and Glasses Vol.

Entine G, Borowski KJ, Lieberman P, Sinclair F, Afshair S, Squillante MR

**138) The large area avalanche photodiode as an X-ray detector**

1987 Proc Sensors Expo Vol. Pages 483-487

Keller K, Farrell R, Epps K

**137) Depth of enhanced maximal exercise performance from increased peak skeletal muscle perfusion during long-term captopril therapy**

1987 J Am Coll Cardiol Vol. 10 Pages 845-850

Mancini DM, Davis L, Wexler JP, Chadwick B, LeJemtel TH

**136) Sensitive CdTe nuclear probe for intra-operative tumor scanning.**

1987 IEEE Nucl Sci Symp, San Francisco Vol. Oct. 21-23

Tiernan T, Sherwood G, Entine G, Hazlett T, Waer P, Hardy JG

### 135) **Check Glass Level Without Burning Resin**

1986 Plast. World Vol.44 Page 66

#### *Abstract*

*With a new type of testing equipment, compounders and processors can determine the amount of glass in reinforced plastics without burning away the resin. The Compuglass system from Radiation Monitoring Devices, Inc., Watertown, Massachusetts, USA uses radiation to check a sample within 2 min. Two levels of sophistication are offered. The basic Model 300 system uses a 0.75 in. beam of radiation and works with simple plastic/glass compounds. The model 200 averages readings from a greater area and works with materials that include metallic fillers and additives. (News Brief).*

### 134) **PROPERTIES OF A NEW CdTe DETECTOR FOR NUCLEAR MEDICINE**

1986 Transactions on Nuclear Science Vol.No. 1 Pages 354-358

Frederick E, Clapp A, Entine G, Hazlett T, Lund JC, Sinclair F, Squillante MR

#### *Abstract*

*A CdTe device structure was investigated for suitability in nuclear medicine instrumentation. These new detectors are room-temperature gamma -ray sensors which have good charge collection and response times of 10-20 ns. Devices 0. 8-mm to 5-mm thick have been characterized with regard to energy resolution and coincidence time interval resolution.*

### 133) **Neutron dosimeter using a dynamic random access memory as a sensor**

1986 Trans. Nucl. Sci. Vol.NS-33

Lund JC, Sinclair F, Entine G

#### *Abstract*

*Soft errors in memory devices caused by ionizing radiation are well known. This sensitivity means that dynamic random access memories can be used as highly efficient, spatially resolved, low cost charged particle detectors. By adding a foil with a high cross section for a (n,alpha) capture reaction, these devices can be made sensitive to thermal neutrons. This will enable the development of a lightweight portable personnel dosimeter.*

### 132) **Avalanche diode low energy X-ray and nuclear particle detector**

1986 IEEE Trans. Nucl. Sci. Vol.NS-33

Squillante MR, Farrell R, Lund JC, Sinclair F, Entine G, Keller KR

#### *Abstract*

*Avalanche diodes which are sensitive enough to detect low energy x-rays and beta particles have been fabricated and tested. They operate at room temperature and their structure is based on large area avalanche photodiodes. X-ray response has been measured over the energy range of 4 keV to 26 keV. At 5.9 keV a FWHM of 10% was obtained. In addition, multi-element sensors have been fabricated. Beta particles were detected from a variety of isotopic sources including C1-36, Sr-90, C-14 and H-3. The tritium beta particles, with 5 keV average energy, were detected with a 20% counting efficiency from a calibrated source. Tritium beta particles from biological samples were also measured. The high sensitivity to low energy x-rays and beta particles makes this detector useful for many industrial, military and commercial applications, and in particular for biomedical research.*

**131) Large, high resolution CdTe gamma ray sensors**

1986 IEEE Trans. Nucl. Sci. Vol.NS-33

Hazlett T, Cole H, Squillante MR, Entine G, Sugars G, Fecych W, Tench O

*Abstract*

*An important need of the nuclear industry is an uncooled, high resolution nuclear spectrometer which would be useful in many applications including post accident monitoring, pipe inspection and health physics. Cadmium telluride detectors with high atomic number and ability to operate at room temperature, have for years been recognized as having the potential to fill the requirements of such an instrument. Previous work indicated that excellent high energy spectroscopy could be achieved using CdTe detectors with rise time discrimination. However, the resulting loss of efficiency was often unacceptable. Recently, a program has been conducted to develop a CdTe spectrometer intermediate in resolution between NaI and HPGe systems using a PIN diode structure. This allows a much larger operating voltage and therefore a much increased photopeak fraction. By combining this device structure with the pulse discrimination technique, both high resolution and good sensitivity can be achieved. In addition the low noise and leakage current of the PIN devices, makes practical the assembly of an array with a single preamp to further increase the sensitivity.*

**130) Detection of deep-red low-level light pulses**

1986 Appl Opt Vol.25 Pages 1514-1518

Burnham R, Scaf D

**129) Detection of active alveolar bone destruction in human periodontal disease by analysis of radiopharmaceutical uptake**

1986 J Periodont Res Vol.21 Pages 677-684

Jeffcoat MK, Williams RC, Holman BL, English R, Goldhaber P

**128) Flurbiprofen treatment of periodontal disease in beagles:**

1986 J Periodontal Res Vol.21 Pages 624--633

Jeffcoat MK, Williams RC, Wechter WJ, Johnson G, Kaplan ML, Gandrup JS, Goldhaber P

**127) An improved technique of intra-operative bone scanning**

1986 J Bone Joint Surg Vol.68-B Pages 643-646

Szypryt EP, Hardy JG, Colton CL

**126) Recent advances in large area avalanche photodiodes**

1985 IEEE Transactions on Nuclear Science Vol.NS-32 Pages 563-566

Squillante MR, Reiff G, Entine G

*Abstract*

*The potential of large area avalanche photodiodes to complement photomultiplier tubes and conventional photodiodes in numerous applications has been demonstrated. In particular, they are compatible with BGO scintillator crystals in important applications such as positron emission tomography and high energy physics research. As scintillation sensors in radiation detectors, one inch diameter avalanche photodiodes have been used to obtain Cs-137, 662 keV spectra with 8.5 percent FWHM resolution coupled to NaI at room temperature and 24 percent FWHM coupled to BGO at 0 C. As low energy X-ray sensors, small devices have a 10 percent FWHM for 5.9 keV Mn, k X-rays. The devices are also extremely sensitive to beta particles.*

### **125) NEUTRON DOSIMETER USING A DYNAMIC RANDOM ACCESS MEMORY AS A SENSOR**

1985 Transactions on Nuclear Science Vol.No. 1 Pages 620-623

Lund JC, Sinclair F, Entine G

#### *Abstract*

*Soft errors in memory devices caused by ionizing radiation are well known. This sensitivity means that dynamic random access memories can be used as highly efficient, spatially resolved, low-cost charged particle detectors. By adding a foil with a high cross section for a (n,alpha) capture reaction, these devices can be made sensitive to thermal neutrons. This will facilitate the development of a lightweight, portable personnel dosimeter.*

### **124) AVALANCHE DIODE LOW ENERGY X-RAY AND NUCLEAR PARTICLE DETECTOR**

1985 Transactions on Nuclear Science Vol.No. 1 Pages 336-339

Squillante MR, Farrell R, Lund JC, Sinclair F, Entine G, Keller KR

#### *Abstract*

*Avalanche diodes sensitive enough to detect low energy X rays and beta particles have been fabricated and tested. They operate at room temperature and their structure is based on large area avalanche photodiodes. X-ray response was measured over the energy range of 4 keV to 26 keV. At 5.9 keV, a FWHM of 10% was obtained. In addition, multielement sensors were fabricated. Beta particles were detected from a variety of isotopic sources, including  $^{36}\text{Cl}$ ,  $^{90}\text{Sr}$ ,  $^{14}\text{C}$ , and  $^3\text{H}$ . The tritium beta particles, with 5 keV average energy, were detected with a 20% counting efficiency from a calibrated source. Tritium beta particles from biological samples were also measured. The high sensitivity to low energy X-rays and beta particles makes this detector useful for many industrial, military, and commercial applications, and in particular for biomedical research.*

### **123) LARGE, HIGH RESOLUTION CdTe GAMMA RAY SENSORS**

1985 IEEE Transactions on Nuclear Science Vol.No. 1 Pages 332-335

Hazlett T, Cole H, Squillante MR, Entine G, Sugars G, Fecych W, Tench O

#### *Abstract*

*An important need of the nuclear industry is an uncooled, high resolution nuclear spectrometer. Such a spectrometer could be used in post-accident monitoring, pipe inspection, and health physics. Cadmium telluride detectors with high atomic number and an ability to operate at room temperature have for years been recognized as having the potential to fill the requirements of such an instrument. Recently, a program was conducted to develop a CdTe spectrometer intermediate in resolution between NaI and HPGe systems using a PIN diode structure. This allows a much larger operating voltage and therefore a much increased photopeak fraction. By combining this device structure with the pulse discrimination technique, both high resolution and good sensitivity can be achieved. In addition, the low noise and leakage current of the PIN devices make it practical to assemble an array with a single preamp to further increase the sensitivity.*

**122) Recent advances in large area avalanche photodiodes**

1985 IEEE Trans. Nucl. Sci Vol.32 Pages 563-566

Squillante MR, Entine G, Reiff G

*Abstract*

*We have demonstrated the potential of large area avalanche photodiodes to complement photomultiplier tubes and conventional photodiodes in numerous applications. In particular, they are compatible with BGO scintillator crystals in important applications such as positron emission tomography and high energy physics research. The photodiodes described here have overcome the limitations in size and sensitivity which had previously prevented the use of avalanche devices in these applications. As scintillation sensors in radiation detectors, one inch diameter avalanche photodiodes have been used to obtain Cs-137, 662 keV spectra with 8.5% FWHM resolution coupled to NaI at room temperature and 24% FWHM coupled to BGO at 0 sup 0 C. As low energy x-ray sensors, small devices have a 10% FWHM for 5.9 keV Mn, k x-rays. The devices are also extremely sensitive to beta particles. These attributes make them useful for detecting ionizing radiation in a wide variety of applications.*

**121) Bone seeking radiopharmaceutical uptake as an indicator of mandibular growth in rats**

1985 Angle Orthodontist Vol.55 Pages 336-344

Cisneros GJ, Jeffcoat MK, Kaban LB

**120) Radiation detection/radiology. (Opinion)**

1985 Medical Electronics Vol.162 Feb

Entine G

**119) Constant sensitivity circuit for solid state nuclear radiation counters**

1985 IEEE Trans Nucl Sci Vol.NS-32 Pages 945-948

Kronenberg S, Erkkila B

**118) Gamma ray detectors with HgCdTe contact layers**

1985 Appl Phys Lett Vol.46 Pages 274-276

Ryan FJ, Shin SH, Edwall DD, Pasko JG, Khoshnevisian M, Westmark CI, Fuller C

**117) Bedside diagnosis of cerebral death based on regional cerebral blood flow measured by a portable Xenon-133 clearance technique. (Abstract)**

1985 SCCM Ann Meeting Vol.May 21-25

Stump DA, Prough DS, Sottile FL, Alford Pt, Entine G.

**116) Prediction of postmenopausal fracture risk with use of bone mineral measurements.**

1985 Am J Obst Gynecol Vol.153 Page 745

Wasnich RD, Ross PD, Heilbrun LK, Vogel JM

*Abstract*

*In a study of 1098 women (mean age, 63.3 years), nonspine fracture incidence and prevalence rates and spine fracture prevalence rates were compared by quintile of bone mineral content as the proximal radius, distal radius, os calcis, and lumbar spine. The risk of fracture associated with varying bone mineral content levels was explored with use of estimated odds ratios. Risk of fracture is significantly increased with diminishing quintiles of bone mineral content. Subjects in the lowest quintile of os calcis bone mineral content have a nonspine fracture risk 10 times greater than subjects in the highest bone mineral content quintile. The os calcis bone mineral content measurement is the best predictor of nonspine fracture risk and is also the best overall indicator of spine fracture risk. Therefore, measurement of os calcis bone mineral content may be useful for routine risk evaluation of perimenopausal women. The ability to predict individual risk should allow for more rational preventive regimens.*

**115) Novel material for visible-blind UV detectors**

1984 Proceedings of SPIE - The International Society for Optical Engineering Vol.2282 Pages 49-56

Misra M, Zhou C, Bennett PR, Squillante MR, Ahmed FI

*Abstract*

*Boron nitride phosphide (BN-xP-1- minus -x) films were grown on single crystal GaAs, using chemical vapor deposition. The films were smooth, well adhered to the substrate and exhibited resistivities on the order of  $10^{15}$  ohm-cm. Photoconductive detectors fabricated from these films showed quantum efficiencies of 33% and 40% at 254 nm and 365 nm respectively, with a drop of an order of magnitude at wavelengths greater than 400 nm. These measurements demonstrate the potential of BN-xP-1- minus -x as a material for visible- blind UV detectors.*

**114) COST REDUCTION IN REINFORCED PLASTICS/COMPOSITES PRODUCTION THROUGH IMPROVED, RAPID, NON-DESTRUCTIVE GLASS AND FILLER CONTENT ANALYSIS**

1984 39th Annual Conference on Reinforced Plastics/ Composites Vol.Jan 16-19, Session 17-D Page 4

Redler E, Boring D, Entine G

*Abstract*

*The goal of this paper is to report cost reduction in RP/C (reinforced plastics/composites) production through on-line implementation of a recently invented technique for the measurement of RP/C glass and filler content. The method originally developed for glass content determination has been expanded to encompass flame retardants and fillers such as CaCO<sub>3</sub>, asbestos, mica, etc. These methods are nondestructive and give results in two minutes. Accuracy has been improved to better than 0. 5% for glass in the presence of other fillers and additives and better than 0. 2% for flame retardants and fillers within two part systems. Quasi on-line instrumentation has been tested for the production of glass reinforced pellets, SMC (sheet molding compounds) and RRIM (reinforced reaction injection molding) with very encouraging results.*

**113) RECENT ADVANCES IN LARGE AREA AVALANCHE PHOTODIODES**

1984 Transactions on Nuclear Science Vol.No. 1 Pages 563-566

Squillante MR, Reiff G, Entine G

*Abstract*

*The authors have demonstrated the potential of large area avalanche photodiodes to complement photomultiplier tubes and conventional photodiodes in numerous applications. In particular, they are compatible with BGO scintillator crystals in important applications such as positron emission tomography and high energy physics research. The photodiodes described here have overcome the limitations in size and sensitivity which had previously prevented the use of avalanche devices in these applications.*

**112) FAST MEASUREMENT OF GLASS-FIBER CONTENT**

1984 Plastics Compounding Vol.7 Pages 77-78

Redler E, Entine G, Ratkowski AJ

*Abstract*

*Glass-fiber content in reinforced composites is a critical parameter in the manufacture of many products. It affects several properties of the final product including strength, flexibility, expansion coefficient, and cost. Although close control of glass content is highly desirable, measurement of this parameter has typically entailed the traditional but time-consuming wet-ash test approach, in which the sample undergoes extensive heat treatment and wet chemistry. This paper presents results of a research program which was undertaken to provide a fast, nondestructive test for glass content that could be performed by nontechnical personnel in a production or QC environment. The analyzer's design and its operation techniques are described in some detail. It is concluded that in addition to significant cost savings, the new technique should enable glass-reinforced products to be produced with tighter specifications. It shows promise for other materials as well.*

**111) Pulse Height Response of CdTe To Heavy Ions**

1984 IEEE Trans Nucl Sci Vol.NS-29 Pages 599-604

Barber HB, Barrett HH, Wild WJ, Woolfenden JM

*Abstract*

**110) Mediastinal parathyroid adenoma: A new method of localization**

1984 Br J Surg Vol.71 Pages 859-860

Ubhi CS, Hardy JG, Pegg CAS

*Abstract*

*<sup>201</sup>Tl-thallos chloride/<sup>99m</sup>Tc sodium pertechnetate subtraction scanning is a simple and accurate means to demonstrate enlarged parathyroid glands. We report a case in which the intra-operative location of a mediastinal adenoma was greatly facilitated by using a probe radiation detector following intravenous injection of <sup>201</sup>Tl-thallos chloride. We believe this is the first reported use of this technique in parathyroid surgery.*

**109) Nuclear medicine: The benefits and the risks**

1984 Viewpoints Vol.April

Wagner HN

**108) BREAKTHROUGH IN QUANTITATIVE GLASS ANALYSIS FOR REINFORCED PLASTICS**

1983 Composite Solutions to Material Challenges; Thirty Eighth Annual Conference, Houston, TX Feb. 7-11 Page 3

Redler E, Entine G, Ratkowski AJ

*Abstract*

*The Compuglass analyzer, developed by Radiation Monitoring Devices Inc., provides a fast, non-destructive test for fiber content of GRP samples to allow on-line process control. The instrument uses a new selective radiation technique to isolate glass.*

**107) FAST GLASS-CONTENT ANALYSIS OF RP**

1983 Mod. Plast. Int. Vol.13 Page 9

*Abstract*

*Radiation Monitoring Devices claim it is possible to measure the glass content of reinforced plastics, in less than two minutes using one of its Compuglass analyzers. Brief details are presented.*

**106) State-of-the-art X-ray detectors fabricated on PCG grown mercuric iodide platelets**

1983 Nuclear Radiation Detector Materials Symposium, Boston, MA Vol.243 Pages 199-206

Squillante MR, Lis S, Hazlett T, Entine G, Haller EE, Kraner HW, Higinbotham WA

*Abstract*

*Recent developments on HgI<sub>2</sub>/ detectors fabricated from platelets grown by the polymer controller growth (PCG) technique have resulted in a better understanding of this remarkable process and provide increased hope for the future of room temperature operable, high resolution X-ray detectors. The benefits of PCG are higher purity using reagent grade materials, better control of stoichiometry, rapid growth, and simplified fabrication. This latter benefit is even more significant when the extreme fragility of HgI<sub>2</sub>/ crystals is considered. The problems of device resolution crystal stability and uniformity, and control of platelet growth were investigated under a NASA funded program. HgI<sub>2</sub>/ devices fabricated from PCG platelets gave room temperature energy resolutions under 400 eV (FWHM) for the 5.9 eV Mn X-ray. Models for the polymer assisted transport are discussed along with an analysis of spectra obtained from PCG grown devices. Reproducibility has been demonstrated both for platelet growth and device performance.*

**105) Large area silicon avalanche photodiodes: photomultiplier tube alternate**

1983 Nuclear Radiation Detector Materials Symposium, Boston, MA Vol.243 Pages 131-140

Reiff G, Squillante MR, Serreze HB, Entine G, Huth GC, Haller EE, Kraner HW, Higinbotham WA

*Abstract*

*Silicon avalanche photodiodes have recently been shown to be a potential replacement for vacuum tube photomultipliers in many nuclear scintillation detector applications. The large active area, low noise, and ease of use of these solid-state photomultipliers makes them ideally suited to scintillation detector applications where overall size and ruggedness are a major concern. Historically, avalanche photodiodes have been limited for use in this capacity by small active areas, low internal gains, and poor optical sensitivity at the wavelengths at which most solid scintillator materials emit. Recent advances as the result of research aimed directly at the solution to these problems however, have successfully demonstrated one inch active area silicon avalanche photodiodes which produce a FWHM resolution of 9.5% for Cs137 at room temperature when coupled to a 1" by 1" NaI(Tl) scintillation crystal. Improvements to both material quality and device structure have advanced the state-of-the-art to make silicon avalanche photodiodes a viable alternative in scintillation gamma spectroscopy as well as for large area optical, beta, and low energy X-ray detectors.*

104) **Scintillation detectors using large area silicon avalanche photodiodes**

1983 Transactions on Nuclear Science Vol.30 Pages 431-435

Entine G, Reiff G, Squillante MR, Serreze HB, Lis S, Huth G

*Abstract*

*Low noise, large area silicon avalanche photodiodes have now been made to replace photomultiplier tubes in certain scintillator detector applications in which overall size and ruggedness are important. Previous devices have been limited by poor optical sensitivity and very small active size. These sensors when coupled to a 1-inch NaI (TI) crystal have produced pulse height spectra with resolution for Cs 137 gamma radiation as low as 9.5% FWHM. This achievement is the result of improvements in both silicon material quality and device design. Based on these results the future prospects of such detectors are very encouraging.*

103) **STATE-OF-THE-ART X-RAY DETECTORS FABRICATED ON PCG GROWN MERCURIC IODIDE PLATELETS**

1983 Materials Research Society Symposia Proceedings Vol.16 Pages 199-206

Squillante MR, Lis S, Hazlett T, Entine G, Haller EE, Kraner HW, Higinbotham WA

*Abstract*

*Recent developments on HgI<sub>2</sub> detectors fabricated from platelets grown by the Polymer Controller Growth (PCG) technique have resulted in a better understanding of this remarkable process and provide increased hope for the future of room temperature operable, high resolution x-ray detectors. The benefits of PCG are higher purity using reagent grade materials, better control of stoichiometry, rapid growth, and simplified fabrication. This latter benefit is even more significant when the extreme fragility of HgI<sub>2</sub> crystals is considered. The problems of device resolution crystal stability and uniformity, and control of platelet growth were investigated under a NASA funded program.*

102) **LARGE AREA SILICON AVALANCHE PHOTODIODES: PHOTOMULTIPLIER TUBE ALTERNATE**

1983 Materials Research Society Symposia Proceedings Vol.16 Pages 131-140

Reiff G, Squillante MR, Serreze HB, Entine G, Huth GC

*Abstract*

*Silicon avalanche photodiodes have recently been shown to be a potential replacement for vacuum tube photomultipliers in many nuclear scintillation detector applications. The large active area, low noise, and ease of use of these solid-state photomultipliers makes them ideally suited to scintillation detector applications where overall size and ruggedness are a major concern. Improvements to both material quality and device structure have advanced the state-of-the-art to make silicon avalanche photodiodes a viable alternative in scintillation gamma spectroscopy as well as for large area optical, beta, and low energy x-ray detectors.*

**101) BREAKTHROUGH IN QUANTITATIVE GLASS ANALYSIS FOR REINFORCED PLASTICS**

1983 38th Annual Conference Preprint - Reinforced Plastics/Composites Institute, Society of the Plastics Industry, RP/C '83: Composite Solutions to Material Challenges, Houston, TX Vol.

Redler E, Entine G, Ratkowski AJ

*Abstract*

*The glass content in reinforced composites is a critical parameter in the manufacture of many products in the RP reinforced plastics industry. Previously the measurement of this parameter required a time-consuming process of burning out the resin and other additives to weigh the glass. This delay results in a large amount of down-time on RP manufacturing lines. In addition, large volumes of product may run out of specification, requiring scrapping or rework. The objective of this research was to develop a fast, non-destructive test for glass content to allow on-line process control. The Compuglass analyzer employs a new selective radiation technique to achieve this goal independent of resin type, fillers, additives and pigments. Samples can be assayed for glass content in two minutes with accuracy better than plus or minus 1%. This type of nondestructive test will allow much greater productivity on the production line. Payback for a variety of industries was reported to be under 4 months.*

**100) Scintillation detectors using large area silicon avalanche photodiodes**

1983 Trans. Nucl. Sci. Vol.30 Pages 431-435

Entine G, Huth G, Lis S, Reiff G, Serreze HB, Squillante M

*Abstract*

*Low noise, large area silicon avalanche photodiodes have now been made to replace photomultiplier tubes in certain scintillator detector applications in which overall size and ruggedness are important. Previous devices have been limited by poor optical sensitivity and very small active size. These sensors when coupled to a 1-inch NaI(Tl) crystal have produced pulse height spectra with resolution for Cs 137 gamma radiation as low as 9.5% FWHM. This achievement is the result of improvements in both silicon material quality and device design. Based on these results the future prospects of such detectors are very encouraging.*

**99) Evaluation of a sterilizable radiation probe as an aid to the surgical treatment of osteoid-osteoma**

1983 J Bone Joint Surg Vol.65A Sept.

Colton CI, Hardy JG

**98) The vest-description of the instrument and initial validation: Emission computed tomography**

1983 Emission Comp Tomography Vol. Pages 263-274

Moore RH, Zielonka JS, Wilson RA, Sullivan PJ, Alpert NM, McKusick KA, Boucher CA, Strauss HW

**97) Ambulatory ventricular function monitor**

1983 Am J Cardiol Vol.52 Pages 601-606

Wilson RA, Sullivan PJ, Moore RH, Zielonka JS, Alpert NM, Boucher CA, McKusick KA, Strauss HW

*Abstract*

*A device for the continuous measurement of left ventricular (LV) function was tested in a series of 34 subjects. The instrument consisted of 2 arrays of radiation sensitive cadmium telluride detectors held in place over the region of the left ventricle and lung by a vest-like garment (hence the name VEST). The VEST electronic instrumentation included analog-to-digital converters, a battery pack, microprocessor and gating device, which were worn in a back pack. Data generated by the VEST, including the digitized average electrocardiogram, RR interval, counts/13 ms in each radiation detector, and time since commencement of data recording, were recorded on a cassette tape recorder every 2 minutes for subsequent analysis. At the conclusion of conventional multigated blood pool imaging, the VEST was positioned and worn by the subjects while supine, standing in place and walking. The correlation of ejection fraction calculated independently from the VEST and scintillation camera data was greater than 0.95. The inter-record reproducibility of the ejection fraction measured by the VEST in sedentary subjects was less than 3%.*

**96) SCINTILLATION DETECTORS USING LARGE AREA SILICON AVALANCHE PHOTODIODES**

1982 IEEE Transactions on Nuclear Science Vol.No. 1 Pages 431-435

Entine G, Reiff G, Squillante MR, Serreze HB, Lis S, Huth G

*Abstract*

*Low noise, large area silicon avalanche photodiodes have now been made to replace photomultiplier tubes in certain scintillator detector applications in which overall size and ruggedness are important. Previous devices have been limited by poor optical sensitivity and very small active size. These sensors when coupled to a 1-inch NaI(Tl) crystal have produced pulse height spectra with resolution for Cs 137 gamma radiation as low as 9.5% FWHM. This achievement is the result of improvements in both silicon material quality and device design. Based on these results the future prospects of such detectors are very encouraging.*

**95) Performance of room temperature X-ray sensors made from mercuric iodide platelets.**

1982 In: Advances in X-Ray Analysis, Plenum Press Vol.25

Barton JB, Dabrowski AJ, Ricker G, Squillante MR, Entine G, et al.

**94) Collimation of portable cadmium telluride detectors for biotelemetry**

1982 J Appl Radiat Isot (Great Britain) Vol.33 Pages 1359-1363

Bojsen J, Staberg B, Kolendord K

**93) Evaluation of a miniature CdTe detector for monitoring left ventricular function**

1982 Eur J Nucl Med Vol.7 Pages 204-206

Harrison KS, Xiujie L, Sun-Tak H, Camargo EE, Wagner HN

*Abstract*

*A miniature CdTe probe interfaced to a microcomputer was used to measure left ventricular ejection fraction (LVEF) in 25 patients. LVEF obtained with the CdTe module, in the beat-to-beat mode, or the integrated gated mode agreed well with LVEF obtained with a gamma camera ( $r = 0.80$ ;  $r = 0.82$ , respectively). Similarly, LVEF by CdTe probe agreed with LVEF obtained by gated equilibrium studies performed with a computerized NaI probe. The CdTe probe can provide comparable measurement of LVEF at a fraction of the cost of a camera-computer system and, being small and lightweight, the CdTe probe is adaptable for monitoring patients in intensive care facilities.*

**92) Regional myocardial radiotracer kinetics in dogs using miniature radiation detectors**

1982 Am J Physiol Vol.242 Pages H849-H854

Jacobs M, Okada RD, Daggett WM, Fowler BN, Strauss HW, Geffin G, Pohost G

*Abstract*

*An implantable device for continuous measurement of regional myocardial radioisotope activity was designed and validated. The probe consists of a 2-mm<sup>3</sup> cadmium telluride crystal surrounded by lead foil housed in a 4.5-mm outer diameter steel cylinder. Activity in serial dilutions of thallium-201 measured by this miniature gamma detector correlated well with activity measured in the well counter ( $r = 0.99$ ). In vivo probe measurements of regional myocardial thallium-201 activity in a canine model were compared with activity in punch biopsies, again with excellent correlation ( $r = 0.90$ ). The crystal was mounted on a modified arterial clamp, which was inserted into the left ventricle through the apex and situated on the endocardial surface of the anterior or posterior wall. It was thus possible to measure regional isotope activity without excessive background from the blood pool and apposite heart wall. The probe was found best suited for monitoring activities of isotopes with energies between 60 and 250 keV. With a pair of these devices, dynamic studies of the myocardial kinetics of radioisotopes such as thallium-201 in normal and ischemic myocardium are now possible.*

**91) Tetracycline treatment of periodontal disease in the beagle dog: Correlation between bone-seeking radiopharmaceutical uptake and rate of bone loss**

1982 J Periodontal Res Vol.47 Pages 545-551

Jeffcoat MK, Williams RC, Kaplan ML, Goldhaber P

**90) Thallium-201 kinetics in non-ischemic canine myocardium**

1982 Circulation Vol.65 Pages 70-77

Okaka RD, Jacobs ML, Daggett WM, Leppo J, Strauss HW, Newell JB, Moore R, Boucher CA, O'Keefe DD, Pohost GM

**89) Mechanisms and time course for the disappearance of thallium-201 defects at rest in dogs**

1982 Am J Cardiol Vol.49 Pages 699-706

Okada RD, Leppo JA, Strauss HW, Boucher CA, Pohost GM

**88) New measurement of the Fano factor of mercuric iodide**

1982 Rev Sci Instrum Vol.53 Pages 700-701

Ricker GR, Vallerga JV, Dabrowski AJ, Iwanczyk JS, Entine G

**87) High quality CdTe substrates for LPE HgCdTE**

1982 Proc. AACG, Lake Tahoe Conference Vol.June

Squillante MR, Saulnier KT, Redler E, Entine G, Lis S

**86) A new tiny computerized radiation dosimeter**

1982 IEEE Trans Nucl Sci Vol.NS-29 Pages 773-774

Wolf MA, Waechter DA, Umbarger CJ

### 85) **Spray pyrolysis prepared CdTe solar cells**

1981 New York, Institute of Electrical and Electronics Engineers, Inc. Vol. Pages 1068-1072

Serreze HB, Lis S, Squillante MR, Turcotte R, Talbot M, Entine G

#### *Abstract*

*Achievement of all thin-film, CdTe-based heterojunction solar cells has been successfully demonstrated using a potentially very low cost chemical spray process. Open-circuit voltages over 600 mV and conversion efficiency up to 4% have been obtained. The active semiconductor layers are extremely thin, and preliminary investigations of wider bandgap windows, alternative acceptor dopants for the CdTe, and cell stability have shown very encouraging results.*

### 84) **Spray pyrolysis prepared CdTe solar cells**

1981 Fifteenth IEEE Photovoltaic Specialists Conference Vol.Kissimmee, FL, May 12-15 Pages 1068-1072

Serreze HB, Lis S, Squillante MR, Turcotte R, Talbot M, Entine G

#### *Abstract*

*Thin films of cadmium telluride (CdTe) have, for the first time, been successfully prepared by a very inexpensive, chemical spray pyrolysis technique. Related to a process developed several years ago to produce materials such as CdS, this new significantly improved technique is a major generalization of the old one, and presents an opportunity to synthesize and deposit in thin-film form many materials. Using this process, the authors have fabricated all thin-film backwall-illuminated CdS/CdTe and Zn/x/Cd/1-x/S/CdTe heterojunction solar cells. Open-circuit voltages in excess of 600 mV, and AM1 conversion efficiencies of up to 4% have been obtained from cells having less than 1 micron total semiconductor thickness. Furthermore, the doped CdS and Zn/x/Cd/1-x/S window layers are directly deposited in low resistivity form without the need for any post-deposition annealing.*

### 83) **Fast, high flux, photovoltaic CdTe detector**

1981 Trans. Nucl. Sci. Vol.28 Pages 558-562

Entine G, Squillante MR, Serreze HB, Clarke E.

#### *Abstract*

*Following its invention by Fox and Agouridis (see Nucl. Instr. Methods, vol.157, no.1, p.65-9, 1978), a CdTe radiation detector, designed for high flux applications, has been improved to give excellent response over a wide range of X-ray and gamma-ray fluxes. This device operates without an externally applied bias and has no dark current, which makes it very sensitive even at low flux. Measurements over a range of  $10/\text{sup } -1/ \text{ R/hr}$  to  $10/\text{sup } 6/ \text{ R/hr}$  show both nearly linear response and high signal-to-noise ratio. Afterglow has been reduced dramatically so that 1 ms time response can be achieved. This advance opens the possibility of using the semiconductor in the 'current mode' of operation for both medical and industrial applications.*

### 82) **Spray pyrolysis prepared CdTe solar cells**

1981 Photovoltaic Specialists Conference Vol.Orlando, FL, May 11

Serreze HB, Lis S, Squillante MR, Turcotte R, Talbot M, Entine G

#### *Abstract*

*Achievement of all thin-film, CdTe-based heterojunction solar cells has been successfully demonstrated using a potentially very low cost chemical spray process. Open-circuit voltages over 600 mV and conversion efficiency up to 4% have been obtained. The active semiconductor layers are extremely thin, and preliminary investigations of wider bandgap windows, alternative acceptor dopants for the CdTe, and cell stability have shown very encouraging results.*

**81) Pn junction formation in CdTe by ion implantation and pulsed ruby laser annealing**

1981 Rad Eff Lett Vol.58 Pages 115-117

Norris CB, Westmark CI, Entine G, Lis SA, Serreze HB

*Abstract*

*Cssup + ion implantation followed by Q-switched ruby laser annealing has been used to fabricate a shallow pn junction in n-type CdTe: In.*

**80) Evaluation of CdTe surface barrier diodes as detectors for energetic charged particles**

1981 Nucl Instrum Methods Phys Res Vol.188 Pages 445-452

Ristinen RA, Peterson RJ, Hamill JJ, Becchetti FD, Entine G

*Abstract*

*CdTe detectors have been studied to determine their response to cyclotron-produced energetic charged particles. The incident ions, primarily protons and helium nuclei, ranged up to 50 MeV in energy. Measurements were made of the linearity of pulse height versus particle energy, energy resolution, efficiency, and the dependence of these on detector bias voltage, temperature, count rate and integrated fast neutron flux. The measurements indicate that CdTe has an energy resolution superior to scintillators, but substantially less than Si detectors for energetic charged particles. Nevertheless, CdTe appears to be useful as a general purpose, high stopping power room temperature device.*

**79) Pulse height response of CdTe to heavy ions**

1981 IEEE Trans Nucl Sci Vol.NS-28 Pages 1546-1547

Becchetti FD, Ristinen RA, Peterson JJ, Hamill J, Thorn CD, Entine G

**78) Beat-to-beat left ventricular performance assessed from the equilibrium cardiac blood pool using a computerized nuclear probe**

1981 Circulation Vol.63 Pages 133-142

Berger HJ, Davies PA, Bastford WP

**77) Portable device for measurement of rCBF in the ICU using CdTe detectors.**

1981 IEEE Trans Nucl Sci Vol.NS-28 Pages 50-54

Correia JKA, Ackerman RH, Buonanno F, Kaufman F, Skiver J, Alpert N, Taveras J, Entine G

**76) Technical and clinical characteristics of a surgical biopsy probe**

1981 J Nucl Med Vol.22 Pages 184-186

Harvey WC, Lancaster JL

**75) A miniature cadmium telluride detector module for continuous monitoring of left ventricular function**

1981 Radiology Vol.138 Pages 477-481

Hoffer PB, Berger HJ, Steidley J, Brendel AF, Gottschalk A, Zaret BL

**74) An evaluation of CdTe surface barrier diodes as detectors for energetic charged particles**

1981 Nucl Instr Methods (The Netherlands) Vol.188 Pages 445-452

Ristinen RA, Peterson RJ, Hamill JJ, Becchetti FD, Entine G

**73) Small radiation detectors for bronchoscopic tumor localization**

1980 IEEE Trans Nucl Sci Vol.NS-27 Pages 496-502

Barber HB, Woolfenden DJ, Donahue DJ, Nevin WS

**72) Miniaturized cardiac module for continuous monitoring of left ventricular performance using a semiconductor gamma detector (Abstract)**

1980 A J Card Vol.45 Page 408

Berger H, Hoffer P, Steidley F

**71) A new radiation sensor for nuclear medicine**

1980 Radiology/Nuclear Med Magazine Vol.Aug. Pages 42-44

Boring DF, Redler E, Entine G

**70) A new solid-state, photovoltaic, high flux radiation detector.**

1980 Presented at Health Physics Soc., 14th mid-year Symp.

Entine G, Squillante MR, Serreze HB, Zammamoff R, Clark E

**69) Continuous monitoring of regional myocardial radiotracer kinetics in laboratory animals**

1980 Am J Cardiol Vol.45 Page 464

Jacobs ML, Okada RD, Strauss HW, Fowler BN, Newell JB, O'Keefe DD, Daggett WM, Pohost GM

**68) Predicting alveolar bone loss in beagles using bone-seeking radiopharmaceutical uptake**

1980 J Dental Res Vol.59 Pages 844-848

Jeffcoat MK, Kaplan ML, Goldhaber P

**67) A CdTe ambulatory ventricular function monitor**

1980 IEEE Trans Nucl Sci Vol.NS-27 Pages 524-528

Lazewatsky JL, Alpert NM, Moore RH, Boucher CA, Strauss HW, Entine G, Chaney R, Schreiner R

**66) Small CdTe gamma backscatter assay meter**

1980 IEEE Trans Nucl Sci Vol.NS-27 Pages 752-756

McVay EJ, Lilienfeld P, Entine G

**65) Multichannel semiconductor detectors for X-ray transmission computer tomography**

1980 IEEE Trans Nucl Sci Vol.NS-27 Pages 252-257

Naruse Y, Sugita T, Kobayashi T, Jimbo M, Fujii M, Yoshida Y, Suzuki T

**64) Building a personal radiation monitor**

1980 Pop Electronics Vol.Jan. Pages 39-46

Steidley J, Nakashian M, Entine G

**63) Horizontal drilling technology for advance degasification**

1980 Mining Engin Vol.June Pages 676-680

Thakur PC, Poundstone WN