

461) **Characterization of multi-element CZT arrays**

2000 SPIE Proceedings Vol.4141 Pages 23-28

Cirignano L, Shah KS, Bennett P, Li L, Lu F, Buturlia J, Yao W, Wright G, James RB

Abstract

We report on device fabrication and testing of CZT grown by the Modified Vertical Bridgman (MVB) method. Several samples of single-crystal MVB grown CZT were obtained from Yinnel Tech. Both single element devices and 2D arrays were fabricated. Resistivity and electron mobility-lifetime product were measured, and pulse height spectra were recorded for various isotopic sources. Arrays 5 mm thick and an array 1.13-cm thick were evaluated.

460) **Characterization of multi-element CZT arrays**

2000 Proceedings of SPIE - The International Society for Optical Engineering Vol.4141 Pages 23-28

Bennett P, Buturlia J, Cirignano L, James RB, Li L, Lu F, Shah KS, Wright G, Yao W

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459) **Multiplexed avalanche photodiode arrays**

2000 Proc SPIE Int Soc Opt Eng Vol.4142 Pages 321-330

Entine G, Farrell R, Souza D, Squillante MR, Wehe D, Woodring M

Abstract

RMD has carried out research to develop a monolithic array of multiplexed, high-gain avalanche photodiodes suitable for use in a spectroscopic radiation-imaging device. To dramatically reduce the electronics required to support a large array we have utilized a unique property of avalanche photodiodes, and the method in which they are produced, to develop a relatively simple readout scheme using row-column addressing. By an additional step in the photodiode creation it is possible to place two, separate diode contacts on the back of each avalanche photodiode in the array. These isolation diodes allow the readout of an entire row or column of photodiodes through a common readout line. By use of a data decoding matrix the position in the array can be uniquely determined while simultaneously supporting the goal of reducing the number of signal readout lines and support electronics. This scheme reduces the number of pre-amplifiers, pulse-shaping circuits, and sample-and-hold stages from n^2 to $2n$ (n pixels) per array. Initial research has been carried out on a 2×2 planar-processed avalanche photodiode array having pixels 2.0 mm^2 . Results indicate that there is good charge sharing between diode contacts on the back of a photodiode, feedback and crosstalk are minimal between avalanche photodiodes connected to a common data line using the diode-contact approach, and that reducing the noise contribution of each separate avalanche photodiode to the common data line remains a critical issue to be examined further. (Author abstract) 16 Refs.

458) Solid solutions (Pb_{1-x}Bi_x)₂-(Bi_{1-x}Pb_x)₃ minus SUB_x

2000 Materials Research Society Symposium - Proceedings Vol.580 Pages 99-104

Dmitriyev Y, Bennett PR, Cirignano LJ, Gupta TK, Klugerman M, Shah KS

Abstract

System (Pb_{1-x}Bi_x)₂-(Bi_{1-x}Pb_x)₃ minus SUB_x of two layered semiconductors Pb_{1-x}Bi_x and Bi_{1-x}Pb_x with various composition were synthesized and grown both as bulk single crystals (by vertical Bridgman method) and films (by thermal vacuum deposition). Grown composites were tested by different techniques (X-ray diffraction analysis, optical transmission, I-V measurements, response to X-ray pulse excitation). Property versus composition showed nonlinear behavior of measured parameters. The structural model of ordered structures formation in this system, which was based upon local electrical neutrality of unit cells, was worked out. It has been experimentally demonstrated that a formation of ordered structures is possible within (Pb_{1-x}Bi_x)₂-(Bi_{1-x}Pb_x)₃ minus SUB_x system, which is consistent with the suggested model. The possibility of crystal structures formation as ordered sets of Bi_{1-x}Pb_x and Pb_{1-x}Bi_x layers was also checked.

457) Screen-printed dye-sensitized large area nanocrystalline solar cell

2000 Materials Research Society Symposium - Proceedings Vol.581 Pages 653-658

Gupta TK, Cirignano LJ, Shah KS, Moy LP, Kelly DJ, Squillante MR, Entine G, Smestad GP

Abstract

The fabrication and testing of screen printed dye-sensitized large solar cell (15 cm multiplied by 15 cm) based on nanocrystalline TiO₂ is described. It is the largest photo-electrochemical (PEC) cell that is based on the dye sensitization of thin (8-18 μm) films of TiO₂ nanoparticles in contact with a non-aqueous liquid electrolyte. The cell has the potential to be a low cost, commercial, environmentally friendly, photovoltaic option. Surface as well as electrical characterization, of the nanostructured PEC cells have been performed. The efficiency of these large commercial cells are compared to the laboratory-made small PEC cells.

456) APD arrays and large-area APDs via a new planar process

2000 Nuclear Instruments and Methods in Physics Research, Section A: Accelerators, Spectrometers, Detectors and Associated Equipment Vol.442 Pages 171-178

Farrell R, Shah K, Vanderpuye K, Grazioso R, Myers R, Entine G

Abstract

A fabrication process has been developed which allows the beveled-edge-type of avalanche photodiode (APD) to be made without the need for the artful bevel formation steps. This new process, applicable to both APD arrays and to discrete detectors, greatly simplifies manufacture and should lead to significant cost reduction for such photodetectors. This is achieved through a simple innovation that allows isolation around the device or array pixel to be brought into the plane of the surface of the silicon wafer, hence a planar process. A description of the new process is presented along with performance data for a variety of APD device and array configurations. APD array pixel gains in excess of 10 000 have been measured. Array pixel coincidence timing resolution of less than 5 ns has been demonstrated. An energy resolution of 6% for 662 keV gamma -rays using a CsI(Tl) scintillator on a planar processed large-area APD has been recorded. Discrete APDs with active areas up to 13 cm² have been operated.

455) **Large area APDs and monolithic APD arrays**

2000 IEEE Nuclear Science Symposium. Conference Record Vol.1 Pages 7-22

Shah KS, Farrell R, Grazioso R, Cirignano L

Abstract

*In this paper, development of large area planar APDs and monolithic APD arrays for scintillation detection is discussed. Single APDs with area as large as 10 cm² have been fabricated and tested with CsI(Tl) scintillator (3.8 cm diameter, 2.5 cm high). The resolution of the 662 keV photopeak has been measured to be 9% (FWHM). Multi-element APD arrays have also been fabricated in various formats such as 4*4 to 14*14 elements (2 mm pixels) and their gain, noise and dark current performance has been characterized. Scintillation and timing studies have also been performed by coupling these arrays to LSO and CsI(Tl) scintillators. Packaging, and electronic readout issues related to these APD devices are discussed.*

454) **Structured LiI scintillator for thermal neutron imaging**

2000 IEEE Nucl Sci Symp Med Imaging Conf Vol.1 6/72 -6/75

Entine G, Gaysinskiy V, Klugerman Y, Nagarkar VV, Squillante MR, Tipnis SV

Abstract

We are currently developing high resolution, high efficiency, micro-columnar LiI films for thermal neutron imaging. The films are produced by the vapor deposition of LiI on a fiberoptic substrate and hermetically sealed in a specially designed aluminum package. Our work has produced up to 1.2 mm thick films with column diameters of approximately 30 μ m. We have also performed imaging studies by optically coupling some of these films to a fiberoptic taper based CCD. The imaging performance of the system was experimentally evaluated at Radiation Monitoring Devices, Inc. as well as at the thermal neutron port of the University of Massachusetts Lowell Research Reactor. The LiI films exhibited excellent scintillation characteristics with a spatial resolution as high as 4.5 lp/mm. This paper outlines the film characterization and performance evaluation conducted during the course of the study. The new sensor described here is expected to usher in the development of large area, high-resolution digital thermal neutron detectors with improved detection efficiency, dynamic range, and faster readout times than the current sensors.

453) **Solid-state neutron detection**

2000 IEEE Nucl Sci Symp Med Imaging Conf Vol.1 Pages 4/131

Bennett PR, Doty FP, Grazioso R, Shah KS

Abstract

A survey of candidate materials to construct an intrinsically neutron sensitive, solid-state conduction counter is reported. Neutron detection is to be achieved through either lithium-6 or boron-10 absorption within the counter's active volume. Readily available materials are fabricated into planar detectors and tested for response to x-ray, alpha particle and neutron irradiation. Individual neutron events are observable in selected materials. Electronic requirements for a solid-state neutron counter, and how well these discovered materials fit them, are discussed.