

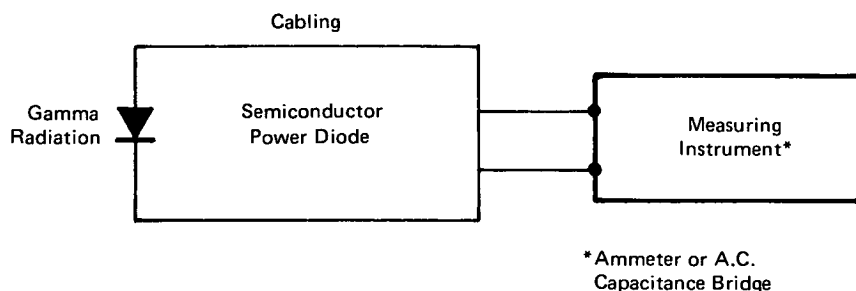
NASA TECH BRIEF

Lewis Research Center



NASA Tech Briefs announce new technology derived from the U.S. space program. They are issued to encourage commercial application. Tech Briefs are available on a subscription basis from the National Technical Information Service, Springfield, Virginia 22151. Requests for individual copies or questions relating to the Tech Brief program may be directed to the Technology Utilization Office, NASA, Code KT, Washington, D.C. 20546.

Simple Dynamic Electromagnetic Radiation Detector



A very simple but reliable detector has been developed for dynamically monitoring gamma dose rates such as are associated with nuclear reactors. Its size and simplicity make it attractive for use in instances where the relatively elaborate ion chamber system may not be needed. For example, this detector can be used to monitor the gamma dose rate at a particular position in a radiation facility where a mixed neutron-gamma environment exists, in order to determine reactor power level changes. In another application, it can be used to map the gamma intensity profile across a neutron-gamma beam.

The entire detector is shown in the figure and consists of a commercial power diode, a measuring instrument, and connecting cabling. Two electrical characteristics of the diode can be measured as a function of gamma dose rate: the short circuit photo current and the diode junction capacitance. The photo current provides considerably greater measurement range since, at zero gamma intensity, the photo current is zero but there is an initial junction capacitance. At higher dose rates, however, the change in photo current and junction capacitance show comparable sensitivities. The detector tested used a 1N1189 silicon power diode. In a gamma radiation environment of approximately 10^6 rads per hour, the photo current from this diode was approxi-

mately 10 microamperes and the capacitance increased ten times.

There are several advantages of a detector of this type when compared to a conventional ion chamber system: (1) there is no need for the ion chamber high voltage power supply and its associated cabling, (2) the sensor can be one-hundredth the size of even miniature ion chambers with comparable output signals, (3) it can be constructed from standard stock items, (4) the response time of the system will be limited generally to the response time of the measuring equipment, and (5) cable leakage and noise problems are considerably reduced.

Notes:

1. In mixed neutron-gamma environments, high neutron fluences may damage the silicon crystal and therefore change the electrical characteristics of the diode. Thus, more frequent calibration and/or replacement will be required if the diode is left in a neutron field for long periods of time.
2. There are many other possible applications of this detector in the measurement of electromagnetic radiations. One such application would be the monitoring of X-ray intensities where the very small size and fast response of the diode would be advantageous.

(continued overleaf)

3. No additional documentation is available. Technical questions, however, may be directed to:

Technology Utilization Officer
Lewis Research Center
21000 Brookpark Road
Cleveland, Ohio 44135
Reference: B72-10227

Patent status:

No patent action is contemplated by NASA.

Source: J. F. Been
Lewis Research Center
(LEW-11159)