

photodiode

Also contains definitions of: avalanche photodiode, PIN (p-intrinsic-n) diode, Schottky-barrier photodiode

A two-electrode, radiation-sensitive junction formed in a semiconductive material. A junction is formed by two successive regions of a semiconductive material having, respectively, an excess of electrons (n-type) or holes (p-type). A bias potential applied to the detector creates a region at the interface that is depleted of majority carriers. Each incident photon produces electron-hole pairs in the depletion region resulting in a measurable signal current. The photodiode can be operated either with zero bias in the photovoltaic mode where the photodiode is actually generating the electric potential supplied to the load. In a biased mode, the photoconductive mode, the reverse current is proportional to the irradiation. A Schottky-barrier photodiode is constructed by deposition of a metal film on a semiconductor surface in such a way that no interface layer is present. The barrier thickness depends on the impurity dopant concentration in the semiconductor layer. The incident radiation generates electron-hole pairs within the depletion region of the barrier where they are collected efficiently and rapidly by the built-in field. A PIN (p-intrinsic-n) diode is a planar diffused diode consisting of a single crystal having an intrinsic (undoped or compensated) region sandwiched between p- and n-type regions. A bias potential applied across the detector depletes the intrinsic region of charge carriers, constituting the radiation-sensitive detector volume. The number of electron-hole pairs produced is dependent on the energy of the incident photons. An avalanche photodiode is a photodiode in which the photogenerated electron-hole pairs are accelerated by a bias potential near to breakdown potential so that further electron-hole pairs are formed leading to saturation of the photocurrent. This operational mode for photon counting is the so-called Geiger mode, similar to that of the gas filled Geiger counter. Avalanche photodiodes can also be operated in the proportional mode.

Source:

PAC, 1995, 67, 1745 (*Nomenclature, symbols, units and their usage in spectrochemical analysis-XI. Detection of radiation (IUPAC Recommendations 1995)*) on page 1755