DEVELOPMENT OF SEMICONDUCTOR AND RESISTIVE GASEOUS DETECTORS

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Keywords: Resistive Plate Chambers; Resistive Detectors; Si Photodiodes; Semiconductor Detectors; Charged-Particle Spectrometry; X- and γ-rays Spectrometry.

1) Resistive Gaseous Detectors: the more recent work we have performed concerns the studies on two resistive detectors performance, one with cylindrical and other with parallel plate geometries, which are operated in proportional regime for the detection of electromagnetic radiations. The origin of the rate effects in the cylindrical detector was investigated by measuring the time dependence of the charge pulse height due to the X-rays from a ^{109}Cd source. The results obtained (FIG.1) allowed to associate the glass polarization effect with the detector charge gain loss through two time decay constants (fast and slow), whose interpretation is our contribution to clarify one of the most important phenomena of resistive detectors. Afterward, it was studied the response of one thin gap (*300 μm*) parallel plate chamber using one ^{60}Co source. The applied voltage influence on the detector gain was verified by the spectra charge analyses what made possible to stablish the chamber operation limits in avalanche mode and the threshold of streamers production in different gases mixtures (six of them first studied). The chamber charge gain and response stability changes due to the presence of small concentrations of sulphur hexafluoride allowed us to observe the excellent quenching properties of this gas.

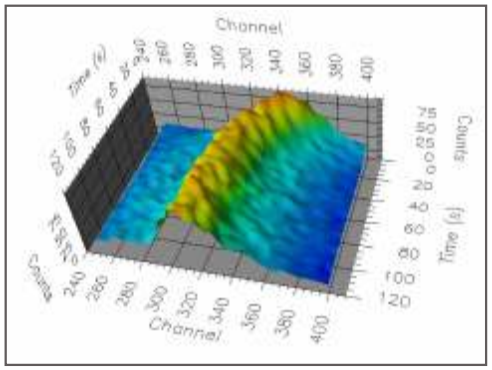

FIGURE 1 - Time dependence of the charge pulse height due to the X-rays from a ^{109}Cd source. Rate = 1232Hz.

2) Silicon Detectors: we have studied the response of an ion-implanted diode (Al/p+/n/n+/Al), developed in the framework of R&D programs for the future CMS experiment at Large Hadron Collider (LHC), for detection and spectrometry of alpha particles and internal conversion electrons envisaging its application to isotopic analysis of heavy elements and in characterization of porous microstructures by X-Ray microtomography. The effects of reverse bias voltage on capacitance and leakage current of the diode, as well as on both the electronic noise and its energy resolution, were also studied at room temperature. The results demonstrate that the diode under investigation has good performance (FIG.2) for alpha spectrometry, comparable to those obtained with ordinary surface barrier detectors. Furthermore, internal conversion electrons with energies up to approximately 350 keV (FIG.3) could be detected with a reasonable good energy resolution. Concerning the detection and spectrometry of X-and γ-rays, the energy resolution was studied using ^{57}Co, ^{133}Ba and ^{241}Am radioactive sources at room temperature. In the energy range between 30 and 360 keV, it was obtained reasonable good energy resolution. Measurements of full-energy peak efficiencies were carried out and compared with the theoretical values. The results have demonstrated that this diode is appropriate for direct detection of low energy electromagnetic radiation.

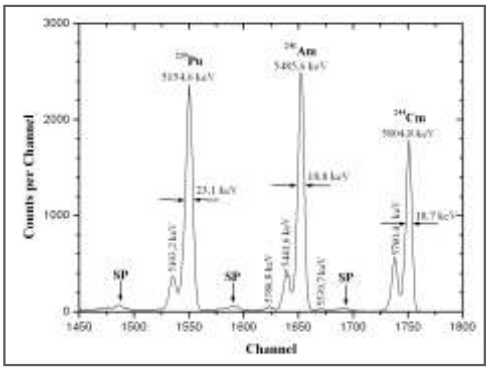

FIGURE 2 - Mixed alpha source energy spectrum with CERN diode (room temperature). ADC = 8192.

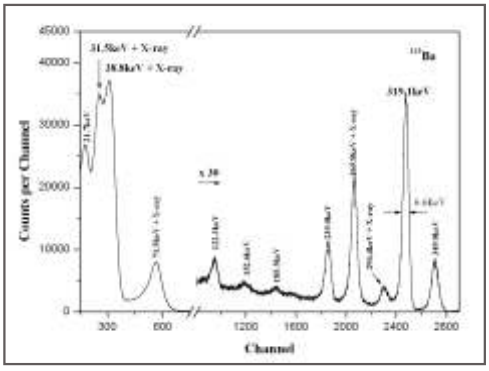

FIGURE 3 - ^{133}Ba electron conversion spectrum for CERN diode (room temperature). ADC = 8192.