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The Radiation Gas Detectors with Novel Nano Porous Converter For Medical Imaging Applications

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Since the scintillation detectors have inherent limitation in spatial resolution, recently, researchers tried to improve the quantum efficiency (QE) of position sensitive gas detectors. This imaging system usually consist of a bulk converter and amplification layer. But a bulk converter has its own limitation. For gamma rays, the converter thickness should be increased to achieve a greater detection efficiency, but in this case, the chance of escaping the photoelectrons is reduced. To overcome this problem, a new type of converter, called a nano porous converter such as Anodizing Aluminum Oxides (AAOs) membrane with higher surface to volume ratio is proposed.

But in this novel converter, even if the pores are filled by a suitable gas, the probability of ionization inside the nano channels is low. To overcome this problem, the walls of the pores are coated with nanometer layer of high density material like gold. In this way, the probability of secondary electrons generation inside the gold nano layer is increased and its energy is enough high to enter the pores. Since, these electrons have lower energy and they have higher chance for multiple scattering from the walls (because of gold layer), so the probability of ionization of the gas inside the pores is increased. In this case, by applying a reasonable electric field, the secondary electrons generated in the pores can be easily collected.

According to simulation results with vGATE_v2.1_1, for the 1mm thickness and inter pore distance of 460 nm, for the gamma ray in the energy range of 20–200 keV, in reasonable range of the gas pressure and for different pore diameters, the QE of this nano porous converter can be one to two order of magnitude greater than the bulk ones, which can be a revolutionary approach for proposing high QE position sensitive gas detectors for medical imaging application.

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