ID de Contribution: **85** Type: **Poster**

Observation of X-ray and proton photoresponse by flexible PbS QD detectors on PEN

In the last few years, research on the detection capabilities of solution-processable materials and nanomaterials has produced devices with excellent X-ray and Gamma sensitivities and detectors with promising proton detection performances. The advantages of solution-processable materials over commercial solid-state detectors include the ease of deposition over a wide range of substrates, lower cost, reduced thickness and, for many materials, optimisation through careful chemical engineering of the active layer, e.g., through blends, linking with functional molecules or passivation of the surface. Perovskite-based detectors often show the highest sensitivities among solution-processable materials, but they are extremely sensitive to humidity and oxygen presence. Detector based on organic semiconductors are often considered tissue-equivalent, a key feature for the use of these devices for dosimetric purposes in the medical (e.g., proton therapy) field. Colloidal Quantum Dots (QD) are a type of semiconducting nanocrystals that has recently started to be employed in ionising radiation detectors. QDs are solution-processed through wet chemistry techniques and can be made with high-Z materials (PbS, PbSe, CdTe etc.) to increase the photoabsorption coefficient with X-rays. QD have size-dependent optoelectronic properties, meaning that characteristics such as their absorption and photoluminescence spectra are dependent on the size of the nanocrystal, which can be controlled during the synthesis. Therefore, devices made with QD can be optimised right from the synthetic step, with further functionalisation after synthesis with the addition of ligand molecules that bind to the QD, changing dramatically some of their properties like carrier lifetime, density of defects and trap states. We recently demonstrated 22keV X-ray detection by a butylamine-exchanged PbS QD photoconductor on silicon, showing promising high sensitivity and limit of detection values, although the detectors showed a slow photocurrent dynamic. We recently demonstrated similar detection capabilities by an electrohydrodynamically printed droplet of PbS QD with Iodine functionalisation on silicon, dramatically improving the speed of response. In this work, we will report on our more recent results on a drop-cast device on plastic (PEN) with PbS QD for X-ray detection. We will describe the key differences and similarities of the device with the similar PbS QD on silicon detectors. These devices were also testes for proton detection in a first, preliminary experiment, achieving a repeatable photocurrent which we observed to be proportional to proton beam current.

Topic

Photosensors

Title

Observation of X-ray and proton photoresponse by flexible PbS QD detectors on PEN

Auteurs: Dr FABBRI, Andrea (INFN Sez. Roma Tre); RUGGIERI, Marco (INFN Sez. Roma Tre)

Co-auteurs: Dr PESCOSOLIDO, Francesca (CNR-IMM); Prof. TORTORA, Luca (INFN Sez. Roma Tre); Dr RAPISARDA, Matteo (CNR-IMM); Dr SCAGLIOTTI, Mattia (CNR-IMM); M. WAQAS, Muhammad (Università degli Studi di Padova); Dr BRANCHINI, Paolo (INFN Sez. Roma Tre)

Orateur: RUGGIERI, Marco (INFN Sez. Roma Tre)

Classification de Session: Poster session - Cocktail