Highlights

RESEARCH AREA 2 - Functional and Complex Materials for Innovative Electronics and Sensing - 2023

Flexible fully organic indirect detector for megaelectronvolts proton beams

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NATURE PHYSICS JOURNAL OF FLEXIBLE ELECTRONICS

A flexible, fully organic detector for proton beams is presented here. The detector operates in the indirect mode and is composed of a polysiloxane-based scintillating layer coupled to an organic phototransistor, that is assessed for flexibility and low-voltage operation (V = −1 V), with a limit of detection of 0.026 Gy min−1. We present a kinetic model able to precisely reproduce the dynamic response of the device under irradiation and to provide further insight into the physical processes controlling it. This detector is designed to target real-time and in-situ dose monitoring during proton therapy and demonstrates mechanical flexibility and low power operation, assessing its potential employment as a personal dosimeter with high comfort and low risk for the patient. The results show how such a proton detector represents a promising tool for real-time particle detection over a large area and irregular surfaces, suitable for many applications, from experimental scientific research to innovative theranostics.

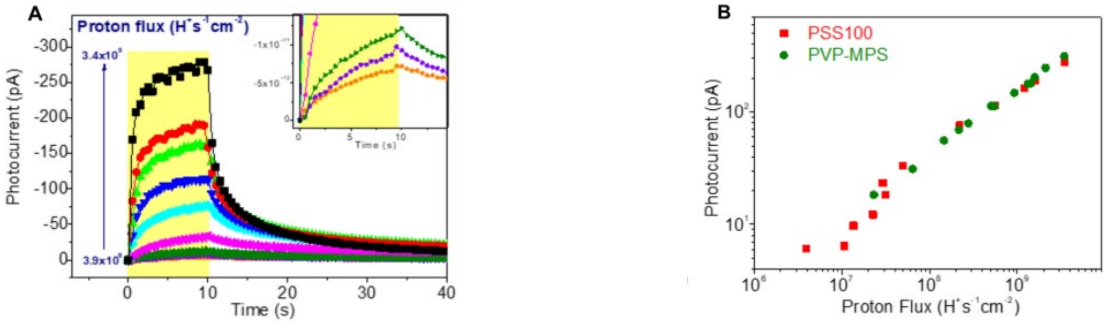

Fig. 1 Proton detection response of fully organic flexible indirect detectors. A: Dynamic response of a detector with a PSS100-based scintillator for different impinging proton fluxes. The inset expands the lower fluxes. Exposure time window: t_{exp} = 10 s; OPT working polarization: V_{ds} = V_g = −1 V. B: Values of the photocurrent normalized to the dark current as a function of the proton flux (red squares for PSS100 and green circles for PVP-MPS scintillators). t_{exp} = 10 s.

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