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# Nanocrystal Enhancement of Low-Cost Scintillators for PET Imaging Application

Positron emission tomography (PET) is a valuable medical imaging technique widely used in the early diagnosis of cancer, as well as in the assessment of cardiovascular, neurological, and metabolic disorders. PET scanners detect pairs of 511 keV gamma rays emitted via the annihilation of positrons from a radioactive tracer injected into the patient. The industry standard detectors used in these systems are typically made from monolithic crystal scintillators, which are costly and contribute significantly to the overall expense of PET scanner production. This greatly restricts access to PET scanners to populations in Africa and the Middle East. Alternative scintillators, such as ceramics and plastics, offer cost advantages but are currently limited by their low light yield, slow scintillation response times, and minimal stopping power at the required energies. In this study, we aim to enhance the scintillation properties of such low-cost scintillators by suspending high-Z nanocrystals in the matrix. This approach aims to combine the favorable characteristics of ceramics and plastics, offering a potential route to affordable and efficient PET detectors suitable for resource-limited settings. To this end, we suspended CdS nanocrystals fabricated by our collaborators at the University of Zululand in epoxy-resin pixels at concentrations ranging from 0.05% to 0.6%, which we characterised at CERN. Standard optical characterisation revealed a red-shift in the emission spectrum with increasing nanocrystal concentration, accompanied by greater light absorption. Scintillation decay times were measured using a time-correlated single photon counting (TCSPC) technique under soft (0–40 keV) pulsed x-ray excitation in reflection mode.

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