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Progress in the Preparation and Characterization of High-Flux CZT detectors

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We have recently realized advanced CZT linear array detectors featuring sub-keV energy resolution, fabricated using high-flux HF-CZT material. These devices, specifically optimized for energy-resolved X-ray imaging, achieve a spatial resolution of 500 μm and an energy resolution better than 0.7 keV FWHM at 60 keV, enabling highly accurate spectral discrimination.
In this study, we report comprehensive X-ray imaging performance results, focusing on how the detectors' superior spectroscopic response enhances the identification of foreign contaminants. We examine in detail the impact of charge-sharing phenomena and of energy-selective acquisition strategies on improvements in contrast-to-noise ratio (CNR). Furthermore, we introduce and evaluate a novel energy-resolved imaging methodology, referred to as window-based energy selection, demonstrating its effectiveness in detecting both low-density and high-density contaminants.
This work is conducted within the framework of national Italian research initiatives aimed at developing next-generation X-ray scanning systems for contaminant detection in the food industry.

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