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Wearable, Lightweight, and Flexible Ionizing Radiation Dosimeters for Real-Time Monitoring

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The development of detectors for high-energy photons, protons, and heavy particles has long been a key research topic, not only for fundamental studies but also for radiation monitoring in harsh environments –such as in hospitals during medical treatments and in outer space exploration. In this context, there is a rapidly growing interest in novels, high-performance, thin, and flexible sensors capable of real-time ionizing radiation detection at affordable costs. This is driven by the limitations of current technologies, which still lack in meeting requirements such as large-area coverage, conformability, portability, low weight, and low-power operation [1].
Recent significant progresses in the field of perovskites have demonstrated their great potential for direct X-ray detection, coupled to unique advantages including solution-processability, cost-effective fabrication and scalability to large area systems. However, they are limited by low bulk resistivity, high trap states density and significant ion migration effects leading to large dark current drift. Among the lead-halide perovskite, X-ray detectors based on polycrystalline low-dimensional (2D layered) lead-halide perovskites have emerged as promising semiconducting materials thanks to their high atomic number, excellent optoelectronic properties, combined with high resistivity, reduced ion migration, and enhanced environmental stability [2].
We present recent developments in X-ray detectors based on low dimensional perovskite films directly deposited onto pixelated flexible substrate. We also report on two devices: one specifically designed for in-situ dose monitor in medical radiotherapy [3, 4], and another developed for space applications within the IRIS project –founded by Italian Space Agency - for real-time radiation monitoring of crew members on the International Space Station.

References

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