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Re-assessment of the air-mediated response in Bi-based perovskite X-ray detectors

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A novel class of perovskite-like materials A3B2X9 (where A= Cs/Rb/MA, B = Sb/Bi, X= Cl/Br/I) has been highly regarded in research community as a sustainable and eco-friendly potential replacement for CdTe and $CsPbBr_3$. Our systematic investigation demonstrates that the X-ray detection performance of these Pb-free materials has been ill-characterized in the past and that the characterization measurements are vitally susceptible to environmental conditions, leading to specious high figures of merit. To decouple the photocurrent contribution by air ionization in these materials and measure their inherent detection performance, a comparative study of X-ray response was conducted in a specifically built chamber while switching its environment between air, argon-filled, and vacuum. After carefully eliminating the plausible deleterious effects of crystallographic orientation, crystal quality, and metallization interface, our findings suggest that nearly a 1000-fold higher X-ray sensitivity may be maneuvered using an argon-filled chamber with smallest metal-semiconductor contact area. The work aims to highlight the importance of air-ionization artefact to be accounted while evaluating X-ray detection response. We encourage a comprehensive X-ray detection characterization for reporting novel materials as X-ray radiation sensors.

References:

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