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CsSb atomically smooth thin films as novel visible light photocathodes

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The so-called "green photocathodes", based on alkali antimonide compounds, are characterized by high efficiency at green light wavelengths (1-10% at 500-550 nm) and excellent charge lifetime, but are easily poisoned in poor vacuum and are usually grown in form of disordered polycrystalline layers. Surface disorder is an extrinsic factor significantly contributing to reduce the transverse beam brightness at the photocathode. State-of-the art deposition techniques have been successfully employed to create smooth and ordered alkali antimonides; for example, epitaxial Cs3Sb photocathodes have been grown by electron diffraction monitored molecular beam epitaxy.* By focusing on structure rather than efficiency, we discovered that atomically smooth films of CsSb can be reproducibly grown on selected substrates. While the quantum efficiency at 505 nm is significantly lower than the Cs3Sb counterpart, this material is still a visible light photocathode (with QE˜0.5-1% at 405 nm) and appears to be more robust against contamination. We report a detailed characterization of this phase via x-ray and UV photoemission spectroscopy, angle resolved photoemission spectroscopy and scanning tunneling microscopy.

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Footnotes

*C.T. Parzyck et al. "Single-Crystal Alkali Antimonide Photocathodes: High Efficiency in the Ultrathin Limit", Phys. Rev. Lett. 128 (11) 114801 (2023)

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