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Atomically smooth films of CsSb: a chemically robust visible light photocathode

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Cs3Sb and related alkali antimonide compounds are high efficiency semiconductor photocathodes that can be operated with visible light and possess quantum efficiency of the order of 1-10% at green light wavelength. Use of these photocathodes in modern linear accelerators is desirable thanks to their potential to generate high brightness electron beams. However, the ultimate brightness of a photocathode is limited by surface disorder of the usually polycrystalline and inhomogeneous films. We used state-of-the-art molecular beam epitaxy to achieve epitaxy of the Cs3Sb phase for the first time, thus realizing ordered, homogeneous surfaces. Furthermore, using in-situ electron diffraction as a structural probe during growth, instead of quantum efficiency, we were able to stabilize atomically flat films with composition Cs:Sb~1:1, a phase characterized by higher photoemission threshold than Cs3Sb, having ~1% quantum efficiency at 405 nm and higher resistance to oxygen poisoning.

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