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Molecular beam epitaxial growth of sodium antimonide photocathodes

The Center for Bright Beams (CBB) at Cornell University has been developing techniques to grow single-crystal photocathodes for electron sources using molecular beam epitaxy (MBE). As a result, the first single-crystal Cs₃Sb photocathode was produced, which has shown high quantum efficiency and is expected to have a low mean transverse energy (MTE). Now, other alkali materials are being explored. In this work, we report the epitaxial growth of Na-Sb photocathodes at the PHOTocathode Epitaxy Beam Experiments (PHOEBE) laboratory at Cornell University. The photocathodes were characterized through quantum efficiency (QE) measurements and reflection high-energy electron diffraction (RHEED) patterns collected during growth. The RHEED streaky pattern shows angle dependence, confirming their single-crystal structure. Notably, these Na-Sb photocathodes exhibited a QE exceeding 1% at 400 nm, which is much higher than previous reports on this compound. The possible reasons for this discrepancy are discussed.

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