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Development of Sodium Potassium Antimonide Photocathodes for Electron Cooling at Brookhaven National Laboratory

The success of electron cooling [1,2] for the Electron-Ion Collider (EIC) relies on the development of high-performance photocathodes (PCs) for photoinjectors. Ideal PCs are expected to exhibit high quantum efficiency (QE), low emittance, long operational lifetime, and minimal dark current. Alkali antimonide photocathodes are strong candidates to meet these demanding requirements. Among them, Na-K-Sb stands out due to its enhanced robustness, especially under high-temperature conditions caused by high-power laser illumination used to generate high-current electron beams [3]. It also offers long-term QE consistency compared to other alkali antimonides such as K2CsSb and Cs3Sb. This work presents the growth and characterization of Na-K-Sb photocathodes, including detailed QE measurements and spatially resolved QE mapping and decomposition behavior under elevated temperatures. These results demonstrate the potential of Na-K-Sb as a promising candidate for high-current, high-brightness electron sources that can significantly enhance the performance of electron cooling systems at the EIC.

Additional Authors

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