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Spectral response and quantum efficiency of rejuvenated Cesium Telluride photocathodes for high average current photoinjectors

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Cesium telluride (Cs-Te) photocathodes are widely used as an electron source in photoinjectors due to their high quantum efficiency (QE) and reliable performance. Unfortunately, they are chemically highly reactive, which limits their operational lifetime and require frequent interventions for Cs-Te film replacement or rejuvenation. The precise control of the Cs-Te deposition stoichiometry ratio during the photocathode fabrication process is essential to optimise the resulting QE and emittance of electron sources. For example, an excess of Cs or the formation of another Cs_xTe phase can lead to a sub-optimal electron bunch energy spread or a decrease in overall quantum yield. In this study, we analyse the photoemissive characteristics of Cs-Te photocathodes rejuvenated by co-depositing a Cs-Te layer over a degraded one. The QE of the photocathodes was measured using a 10 Hz 5 ns pulsed OPO in the wavelength range from 240 to 430 nm. This experiment allows to estimate the photoemission threshold and corresponding energy distribution of emitted electrons, and to compare with the expected spectral response.
Our results contribute to a deeper understanding of Cs-Te photocathodes and provide practical insights for optimising production to improve performance and reliability.

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