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High brightness electron source development in Tsinghua university

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High brightness electron source is a key component for accelerator based scientific instruments. The beam brightness can be further improved with the combination of high electric field and low thermal emittance cathode. We develop an ultrahigh vacuum S-band electron gun to accommodate advanced semiconductor photocathodes, which are easily degraded in poor vacuum condition. The high power test of ultrahigh vacuum S-band gun has finished and the axial electric field has reached over 100 MV/m with dark current around 500 pC. The vacuum under operation is 2.08×10^{-8} Pa, which is one of the best vacuum condition with regards to such high gradient operation. The gun has been operated with Cs₂Te cathode for 3 months without quantum efficiency (QE) degradation. Advanced photocathode deposition system has been setup in a clean room and the deposited photocathodes are transferred through suitcase to load lock system in ultrahigh vacuum environment. We have deposited K₂CsSb cathode in the deposition system. The QE is between 1% and 4.5% with driven laser wavelength of 532 nm. The QE and thermal emittance of the K₂CsSb have been measured under high gradient in the gun and results are presented in the paper.

Footnotes

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