Enhanced Quantum Efficiency of Strained GaAs/GaAsP Superlattice Photocathode with Distributed Bragg Reflector

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Abstract

Photocathodes with higher polarization and quantum efficiency (QE) can significantly enhance the physics capabilities of electron accelerators. In this submission, we describe the characteristics of strained GaAs/GaAsP superlattice photocathodes fabricated with a Distributed Bragg Reflector (DBR). The distributed Bragg reflector (DBR) concept was proposed to enhance the QE of strained-superlattice photocathodes by increasing the absorption of the incident photons using a Fabry-Perot cavity formed between the front surface of the photocathode and the substrate that includes a DBR, without compromising electron polarization. A typical strained GaAs/GaAsP superlattice photocathode provides polarization near 90% and QE $\sim$ 1%. Simulations suggest that a properly fabricated DBR photocathode structure will increase QE by a factor of five. Presently, we measure a polarization of 90.7% but only 0.92% QE at the laser wavelength of 780nm. We continue to try to enhance the QE beyond the nominal 1% value by optimizing the DBR structure.

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