

Initial emittance measurements for polarized electron gun with NEA-GaAs type photocathode

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NEA-GaAs type photocathodes have used as spin polarized electron sources. The band structure of GaAs crystals and Negative Electron Affinity (NEA) surface enable to extract spin polarized electrons into a vacuum. In addition with this advantage, some recent studies indicated that NEA type photocathodes have a great added advantage of generating electron beams with much lower emittances. Because the transverse energies of electrons extracted from NEA surface can be suppressed almost equal to the thermal energies of room temperature.

In order to demonstrate this advantage, we measured the beam emittances using a strained GaAs photocathode and a GaAs-GaAsP strained super-lattice photocathode for various excitations wavelengths. We carried out the emittances measurements with very low charges electron beams and small beam sizes, such as the beam currents of approximately 10nA and the laser spot diameters of smaller than 1mm. In addition, to suppress the emittance increase by space charge forces, the extracted beams were immediately accelerated to the energy of 120 keV using our 200kV-gun, which has been developed for the future international linear collider project. The beam line for the emittance measurements consisted of a pepper pot mask and scintillation screen followed by a drift space of 1m from the 200kV-gun.

As results of these experiments, the normalized horizontal beam emittances of lower than 0.1 pi.mm.mrad were measured.

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