Transport Mechanisms in Polarized Semiconductor Photocathodes

K. Ioakeimidi, A. Brachmann, J.E. Clendenin, E.L. Garwin, R.E. Kirby, T. Maruyama and C.Y. Prescott

Stanford Linear Accelerator Center, Menlo Park, California 94025, U.S.A.

R. Prepost

Department of Physics, University of Wisconsin,Madison, Wisconsin 53706, U.S.A.

G.A. Mulhollan, J.C. Bierman

Saxet Surface Science, Austin, Texas, 78744, U.S.A.

ABSTRACT

We investigated the effect of an accelerating field on the photogenerated electrons in a 100nm long GaAs based photocathode active region. By decreasing the transport time of electrons we expected to decrease the scattering events that cause depolarization as indicated by Monte Carlo simulations of the scattering and transport time statistics of the electrons.

A tungsten grid of 1micron thickness and tens of microns spacing was deposited on the cathode surface to provide a uniform voltage distribution across the cathode surface. The metal grid forms a Schottky contact with the semiconductor surface. The bias voltage is primarily dropped at the metal semiconductor interface region, which is the cathode active region. For positive surface bias, the accelerating voltage not only increased the polarization, but it also enhanced the quantum efficiency of the photocathode. Preliminary results verify the bias effect.