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Evaluating the Field Emission Characteristics of Aluminum for DC High Voltage Photo-Electron Guns[1] RHYS TAUS, Loyola Marymount University, MATTHEW POELKER, ERIC FORMAN, ABDULLAH MAMUN, Thomas Jefferson National Accelerator Facility — High current photoguns require high power laser light, but only a small portion of the laser light illuminating the photocathode produces electron beam. Most of the laser light ($\sim 65\%$) simply serves to heat the photocathode, which leads to evaporation of the chemicals required to create the negative electron affinity condition necessary for photoemission. Photocathode cooling techniques have been employed to address this problem, but active cooling of the photocathode is complicated because the cooling apparatus must float at high voltage. This work evaluates the field emission characteristics of cathode electrodes manufactured from materials with high thermal conductivity: aluminum and copper. These electrodes could serve as effective heat sinks, to passively cool the photocathode that resides within such a structure. However, literature suggests "soft" materials like aluminum and copper are ill suited for photogun applications, due to excessive field emission when biased at high voltage. This work provides an evaluation of aluminum and copper electrodes inside a high voltage field emission test stand, before and after coating with titanium nitride (TiN), a coating that enhances surface hardness.

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