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Prformance of laser patterned copper plasmonic photocathodes

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We study ultrafast laser surface nanopatterning as an alternative to improve the photo-emissive properties of metallic photocathodes. By tailoring the physical dimensions of these surface nanostructures, one can localize the optical field intensity and exploit plasmonic effects occurring in such nanostructures. As a result, this surface nanopatterning technique can become a great tool for improving metallic photocathodes photoemission behavior enabling their use for next generation high brightness electron sources. Our goal is to investigate such surface-plasmon assisted photoemission processes with a view on simplifying the photocathode production at CERN while extending the lifetime of existing photoinjectors. The performance of two different femtosecond laser nanopatterned plasmonic photocathodes was analyzed by measuring the quantum yield with a 65kV DC electron gun utilizing 266nm laser excitation generated by a nanosecond laser with 5ns pulse duration and 10Hz repetition rate. By comparing the electron emission of the copper surface nanostructured areas with that of a flat area, our results suggest quantum yield enhancements of up to 5 times.

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