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Characterisation of a Cs-implanted Cu photocathode

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The generation of high–brightness electron beams is a crucial area of particle accelerator research and development. Photocathodes which offer high levels of quantum efficiency when illuminated at visible wavelengths are attractive as the drive laser technology is greatly simplified. The higher laser power levels available at longer wavelengths create headroom allowing use of manipulation techniques to optimise the longitudinal*and transverse** beam profiles, and so minimise electron beam emittance.

An example of this are bi-alkali photocathodes which offer quantum efficiency ˜ 10% under illumination at 532 nm. Another solution is the use of modified photoemissive surfaces. Caesium has a low workfunction and readily photoemits when illuminated at green wavelengths (˜532nm). Caesium oxide has an even lower workfunction and emits at red wavelengths (˜635nm).

We present data on our work to create a hybrid copper photocathode surface modified by implantation of caesium ions, measuring the surface roughness and probing its structure using MEIS. We measure the energy spread of photoemitted electrons, the QE as a function of illumination wavelength, and the practicality of this surface as a photocathode by assessing its lifetime on exposure to oxygen.

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Footnotes

*G. Vashchenko et al.; Proc. IPAC 2014; 689-691;
https://accelconf.web.cern.ch/FEL2014/papers/thp007.pdf

**J. Maxson et al.; PRSTAB 18,023401 (2015); doi:10.1103/PhysRevSTAB.18.023401

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