13th FIELD EMISSION SYMPOSIUM

September 6-10, 1966
CORNELL UNIVERSITY
Field Ion Microscopy of Beryllium

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The FIM image properties of beryllium are of interest for various reasons: the small lattice constant of \( a = 2.27 \text{ Å} \) provides a resolution test. The low atomic mass suggests a better thermal accommodation of the imaging gas, so that a reduced imaging field can be expected. An effect of the electronic structure of a metal on field ionization and field evaporation should be more striking with beryllium because of the unusual form of the Fermi surface.

Samples of zone refined and "impure" (containing 2\% BeO) beryllium were investigated. Both annealed and non-annealed wires were examined; the non-annealed wire resulted in better tip shapes. Various polishing techniques were applied. Best results were obtained with hot concentrated potassium hydroxide.

The helium ion image can be observed visually. Adjacent atoms of 2.27 Å spacing were seen resolved on the edge of the (10\( \bar{1} \)0) plane. At large tip radii the helium ion image is marginally stable for direct photography. Better results with helium as well as with neon were obtained using the image intensifier. The image exhibited extreme contrast, with extended crystallographic areas completely dark. This may be due to a strong anisotropy of field evaporation, causing the formation of low field regions, or an anisotropy of field ionization by the electronic structure of the metal. Both the helium and the neon ion image appeared much brighter than the corresponding images of a more massive metal such as tungsten, probably due to the improved accommodation.

Imaging in hydrogen was also attempted, but abandoned due to the rapid attack of the beryllium tip.
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