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Electron Emission Sources THEODORE VECCHIONE, GARY HEMBREE, UWE WEIERSTALL, JOHN SPENCE, Arizona State University Department of Physics, NIGEL BROWNING, Lawrence Livermore National Laboratory — Laser-pulsed photo-field-emission sources with high coherence and brightness are needed for time-resolved electron microscopy. Our ongoing work explores the possibility of using sharpened semiconductor electron emitters to achieve this goal. Intrinsic GaAs field-emission sources have been prepared from cleaved needles that are clipped into refractory metal holders. These needles are chemically sharpened and surface cleaned by field-desorption and electron-bombardment heating. Field emission I-V curves have been analyzed, with and without laser illumination, which demonstrate a range of metallic and semiconductor characteristics. He-Ne laser illumination has been observed to increase field emission currents by more than an order of magnitude. The band structure of a semiconductor can be used to create a lower bound on the energy of photo-excited field-emitted electrons, producing a beam whose energy width is $E = E_g - h\nu$ (bandgap E_g). Energy analysis is planned using a hemispherical analyzer, aimed at achieving an energy spread less than the 0.26 eV of conventional W tips. Calculations are underway to understand complications arising from surface effects and bulk transport. NNSA award DE-PS52-05NA funds this research.

Photo-Field

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