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Investigating Dirac semimetal cadmium arsenide as a potential low-MTE photocathode

We report on the quantum efficiency (QE) and mean transverse energy (MTE) of photoemitted electrons from cadmium arsenide (Cd_3As_2), a three-dimensional Dirac semimetal (3D DSM) of interest for photocathode applications due to its unique electronic band structure, characterized by a 3D linear dispersion relation at the Fermi energy. Samples were synthesized at the National Renewable Energy Laboratory (NREL) and transferred under ultra-high vacuum to Arizona State University (ASU) for measurement using a photoemission electron microscope (PEEM). The maximum QE was measured to be $3.37 \cdot 10^{-4}$ at 230 nm, and the minimum MTE was 55.8 meV at 250 nm. These findings represent the first reported QE and MTE measurements of Cd_3As_2 and are an important step in evaluating the viability of 3D DSMs as low-MTE photocathodes. Such photocathodes, constrained to lower MTEs by the electronic band structure, may prove effective in advancing beam brightness in next-generation instruments and techniques.

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