Docket #: S21-100

Novel Semiconducting Materials for High Brightness and Air Stable Photocathodes

Stanford researchers have developed a method of designing materials for air-stable and high-brightness photocathodes. Challenges with current photocathode materials' lie with in brightness and extreme air sensitivity. This method addresses those challenges by first identifying semiconducting materials with high-brightness, then selects those which are air-stable. High-brightness is evaluated by calculating the intrinsic emittance: lower intrinsic emittance leads to higher brightness when used as a photocathode. The software was able to identify 11 novel materials, with some displaying brightness 16x larger than current state-of the art materials.A machine learning algorithm then aids in the discovery of air stable materials in order to eliminate the need for ultra-high vacuum environments. The identified class of M_2O materials can be used as air-stable and high-brightness materials; overall they simplify fabrication, synthesis and storage of photocathodes while increasing their longevity.

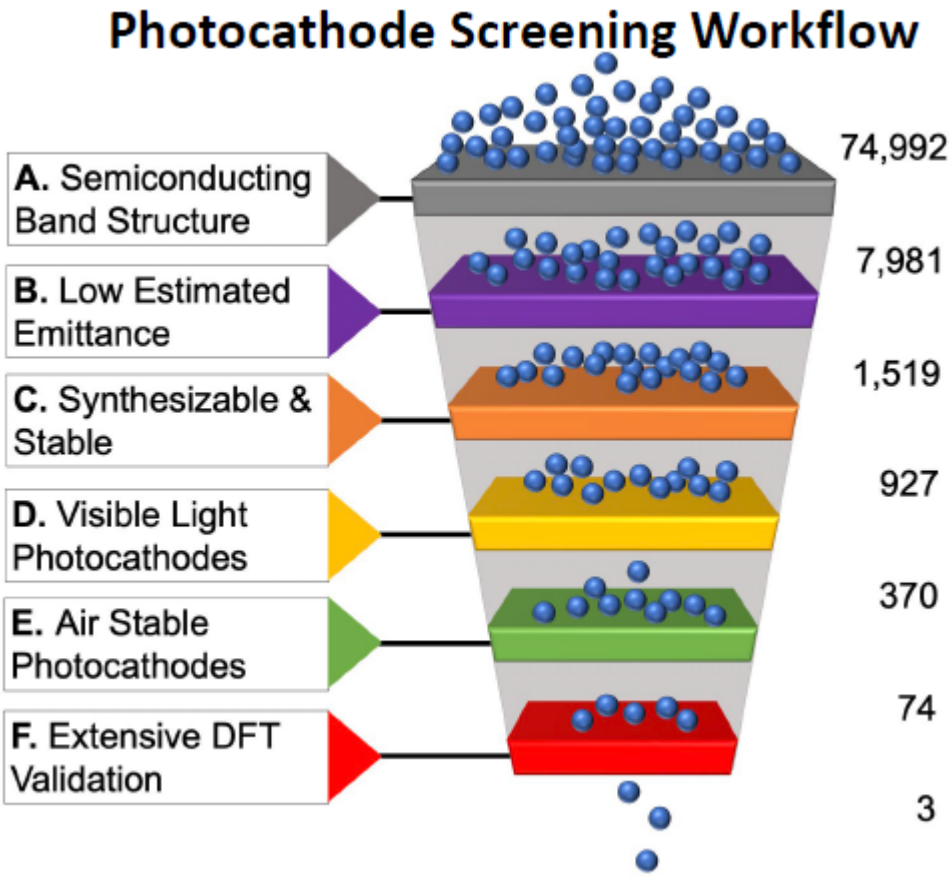

Photo description: Photocathode material screening workflow.

Stage of Research

- Proof of concept

Applications

- **Light detectors: photomultiplier tubes, free-electron lasers, night vision devices**

Advantages

- **Air-stable photocathodes for longer operational lifetimes**
- High-brightness photocathodes predicted to be 16x brighter than K_2CsSb

Publications

- Antoniuk et al. Physics Review B (2020) Generalizable Density Functional Theory Based Photoemission model for the Accelerated Development of Photocathodes and Other Photoemissive Devices

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