NASA SBIR/STTR Technologies

Highly Efficient FUV Photodetector with AlGaN Nanowire Photocathode

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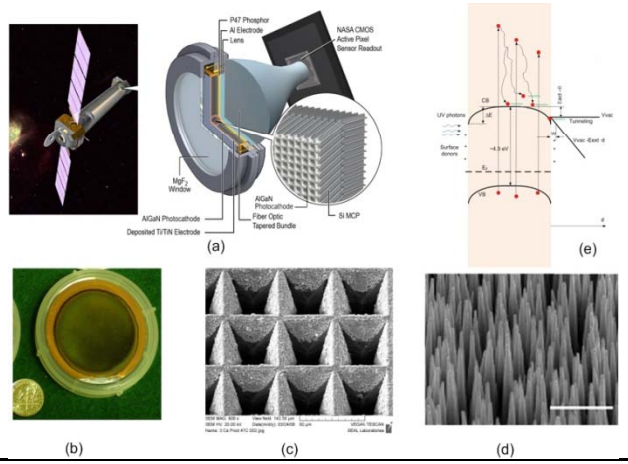
Identification and Significance of Innovation

To address NASA needs for efficient photodetectors for new UV space instrumentation, Physical Optics Corporation (POC) proposes to develop a new Silicon Microchannel-Plate-Based UV detector with a solar-blind, highly efficient photocathode fabricated directly on the surface of the microchannel plate and consisting of Mg-doped Alga nanowires grown on the entrance MCP walls (NW-Si-MCP). The photocathode will have quantum efficiency >50% in the UV spectrum, with a sharp cutoff below the visible range. The improvement in photodetector efficiency and its large size will significantly reduce requirements for future space UV telescopes and other mission instrumentation, without sacrificing performance parameters. At the end of Phase I, the photodetector will reach TRL-4, and TRL-6 by the end of Phase II.

Application scenario and design of NW-Si-MCP photodetector (a); silicon microchannel plate and AlGaN nanowire photocathode (b-d); energy bands diagram of AlGaN nanowire photocathode with Negative Electron Affinity(e).



Technical Objectives

1. Development of a preliminary design of the proposed NW photocathode and NW-Si-MCP, and analysis to determine optimal parameters.
2. Optimization of technologies for fabrication and activation of the Alga NW photocathode for the NW-Si-MCP photodetector.
3. Fabrication and evaluation of Alga NW photocathode.
4. Preliminary establishment of the commercial promise of the NW photocathode technology.

Work Plan

1. Optimize NW photocathode structure and composition.
2. Prepare substrates for Alga NW photocathode growth.
3. Optimize HVPE technology for growth of Alga NW photocathode on metal-covered Si wafers.
4. Investigate the morphology and composition of fabricated AlGaN NW photocathode structures.
5. Optimize the activation procedure and measure the quantum efficiency of AlGaN NW photocathode.
6. Explore the commercial potential and product viability.
7. Prepare and submit reports.

NASA Applications

UV telescopes and spectrometers for future missions within Explorers, Discovery, Origins, Beyond Einstein, and Vision programs. Current and future missions that rely on this technology include HST-STIS, GALEX, COS, EUVE, XMM-OM, CHIPS, and FAUST.

Non-NASA Applications

Missile plume detection, investigation of metabolism in organic cells by monitoring UV fluorescence, atmospheric research, and over the line-of-sight covert communication.

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NON-PROPRIETARY DATA