



Inventors

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High Speed Sensitive Mid-infrared Photodetectors at Room Temperature Based on Graphene-hybrid Structures

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Background

High speed mid-infrared (MIR) photodetectors are crucial in numerous applications, ranging from hyper-spectral imaging and biomedical sensing to environmental monitoring and astronomy. However, fundamental limitations in current technologies restrict the scope of use for these photodetectors. Current technologies suffer from weaknesses such as reduced sensitivity, delayed response time, narrow operational conditions, and limited wavelength range. Furthermore, high speed MIR photodetectors are expensive to manufacture and are rarely compatible with commonly-used complementary metal-oxide-semiconductor (CMOS) technologies. Therefore, there is a need for a cost-effective high speed MIR photodetector that also has increased functional range.

Invention Description

Researchers at Arizona State University have invented a graphene-based photodetector that is less expensive and more effective than current photodetector technology. A single layer of carbon atoms is used to absorb photons from the ultraviolet to far infrared, and thus able to detect the entire MIR wavelength range. This highly sensitive photodetector operates at room temperature and has a short response time. The ultra-thin, lightweight design is compatible with CMOS technology and capable of large-scale production of MIR imaging systems. Furthermore, this technology enhances the optical absorption in graphene to approximately 90% and eliminates detector noise due to dark current.

Intellectual Property Status:

Pending

Potential Applications

- Infrared Detection
- Photonics
- Spectroscopy
- Imaging
- Astronomy

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Benefits and Advantages

- **Compatibility** – Compatible with CMOS technology, unlike many current MIR photodetectors.
- **Scalable** – Offers a low-cost alternative for large-scale MIR imaging production.
- **Improved Response Time** – Nanosecond response times produce faster and more accurate results.
- **Reduced Noise** – Eliminates dark current interference and detector noise.
- **Lower Costs** – Less expensive technology, especially for large-scale operations.