Skysong Innovations
Advancing the Arizona State University Knowledge Enterprise

1475 N. Scottsdale Road, Suite 200
Scottsdale, AZ 85287-3538
Phone: 480 884 1996 Fax: 480 884 1984

Case ID:M16-209P^
Published: 2/26/2020

Inventors

Zhaoyu He

Yong-Hang Zhang

Contact

Shen Yan
shen.yan@skysonginnovations.com

Low-Voltage Charge-Coupled Devices with a Heterostructure Charge-Storage Well

The charged-coupled device (CCD) is commonly known for its applications in digital cameras and infrared photodetectors. Although this device has been revolutionary within imaging applications, there are some shortcomings that can be improved. For instance, a conventional CCD requires a very high external voltage. High power consumption means that portable cameras using a CCD imager are prone to a shorter battery life and have excessive amounts of unwanted noise. Moreover, a single semiconductor material is typically used to absorb light and store charge. This is detrimental because it leads to band bending and depletion in the absorber layer of the device. Clearly, there is a need to overcome these problems in order to improve the technologies that use CCD imagers.

Researchers at ASU have developed a new technology that lowers power consumption and the signal-to-noise ratio in CCD imagers. One change that is monumental to the CCD is switching from a single material semiconductor to a heterostructure semiconductor with type-II bandgap alignment. This achieves a charge-storage well with lateral read out and eliminates the need of external voltage for this utility. Furthermore, properly doping the charge-storage layer of the CCD eliminates band bending. Creating a flat band minimizes noise, and relaxes the need for high quality material. Both of these changes result in lower power consumption and increased battery life.

Potential Applications

- Digital Cameras
- Machine Vision for Robots
- Processing Satellite Pictures
- Enhancement of Radar Imaging

Infrared Focal Plane Array

Benefits and Advantages

- Lateral Readout
  - Lower power consumption
  - High dark current is eliminated
- Type II Band Structure – Efficient hole trapping
- Lowers Cost – Reduces manufacturing cost

For more information about the inventor(s) and their research, please see

Dr. Yong-Hang Zhang's Directory Page