Signal Amplification: New Methods and Devices

Tech ID: 23268 / UC Case 2013-206-0

TECHNOLOGY DESCRIPTION

University researchers have developed device fabrication concepts, methods and devices that pertain to signal amplification well beyond the conventional photoresponse limit (one photon produces at most one electron-hole pair). The photoresponse amplification is based on a new carrier multiplication mechanism referred to as a “cycling excitation process” to produce high gain and low noise. The invention has broad potential applications for communication, imaging, sensing, and computing where signal amplification is necessary and ubiquitous, as well as in high conversion efficiency photovoltaics.

In an exemplary embodiment, photoresponse amplification is obtained in heavily doped, partially compensated silicon p-n junctions under very low bias voltage. The photocurrent gain occurs at a bias that is more than an order of magnitude below the threshold voltage for conventional impact ionization and the photocurrent increases with bias voltage and with temperature. Contrary to the case of avalanche detectors and p-i-n diodes, the amplified photoresponse is enhanced rather than suppressed with increasing temperature. Such an internal signal amplification mechanism, which occurs at much lower bias than impact ionization and favors room temperature over cryogenic temperature, makes it promising for practical device applications.

This technology has patents pending and is available for licensing and research sponsorship.

RELATED MATERIALS

- New Signal Amplification Process Set to Transform Communications, Imaging, Computing, AIP Press Release - 01/20/2015
- Discovery of a photoresponse amplification mechanism in compensated PN junctions, Appl. Phys. Lett. 106, 031103 (2015) - 01/01/2015

INTELLECTUAL PROPERTY INFO

The invention has patent pending and is available for research sponsorship and/or licensing.

PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Published Application	20160005887	01/07/2016	2013-206

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OTHER INFORMATION

KEYWORDS

silicon, conversion efficiency, solar cells, photodetectors, signal amplification, optoelectronics, photovoltaics, semiconductors, p-n junctions

CATEGORIZED AS

- **Optics and Photonics**
  - All Optics and Photonics
- **Energy**
  - Solar
- **Semiconductors**
  - Materials
  - Processing and Production
- **Sensors & Instrumentation**
  - Other

RELATED CASES

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