A Method for Making Low-Cost Silicon Devices with Reduced Inactive Area

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BACKGROUND

Modern semiconductor detectors have been developed for sensing light, X-rays and charged particles. Such devices have established broad applications because of their reliability, and compactness. However, they typically contain an inactive area near the edges of the device. This scheme allows for dicing of the wafers (thin slices of semiconductor material) resulting in large device defect densities. Also, the existence of up to a 1mm wide inactive band leads to efficiency gaps when a larger surface is covered with many such devices. Researchers at UCSC in collaboration with the U.S. Naval Research Laboratory (NRL) have developed methods for fabricating resistive semiconductor sidewalls near the active area that allow deep depletion operation. These methods can be used to make compact, low-cost sensor devices without inactive periphery. Moreover, this robust and scalable method could be used for IC (integrated circuit) production, power electronics IC production, radiation detector (or sensor) production, imaging sensors, and solar cell production.

TECHNOLOGY DESCRIPTION

UCSC and NRL researchers have invented methods for fabricating resistive sidewalls that can be placed in proximity to an active region of a sensor with high electric field. The new semiconductor method has been prototyped and evaluated with high levels of success. The basic technology involves low-damage device singulation followed by post-processing of the sidewall. The low defect density of the sidewall surface, followed by imposition of a proper interface charge, creates the resistive sidewall. The new method can be used in both n-type and p-type silicon devices. For n-type silicon, an elevated temperature or UV light exposure is adequate to form passivating oxide. For p-type silicon an ALD deposition of alumina creates a negative interface charge, needed to passivate the edge. Also, the applied voltage of the invention generates an electric field within the semiconductor. Therefore, sensors have been created with distance between the active area and the sidewall as small as 14 microns.

APPLICATIONS

- Integrated circuit (IC) production
- Power electronics IC production
- Radiation detector (or sensor) production
- Imaging sensors
- Solar cell production

ADVANTAGES

- Compact sensor devices with minimal inactive periphery
- Cost-effective and eco-friendly

INTELLECTUAL PROPERTY INFORMATION

Country	Type	Number	Dated	Case
United States Of America	Issued Patent	8,841,170	09/23/2014	2011-253

CONTACT

University of California, Santa Cruz
Industry Alliances & Technology Commercialization
innovation@ucsc.edu
tel: 831.459.5415.

INVENTORS

- Sadrozinski, Hartmut F.-W.

OTHER INFORMATION

KEYWORDS

Fabricating, sidewalls, laser scribing, n-type, UV Light, passivate, device, package, Semiconductors, Assembly & Packaging, Design & Fabrication, Processing & Production, Sensors & Instrumentation, Position Sensors, Scientific/Research, Research Tools, Se, Cat4

CATEGORIZED AS

- **Energy**
  - Solar
- **Imaging**
  - Other
- **Semiconductors**
  - Assembly and Packaging
  - Design and Fabrication
  - Materials
  - Processing and Production
- **Sensors & Instrumentation**
  - Other
- **Engineering**
  - Other

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University of California, Santa Cruz
Industry Alliances & Technology Commercialization
Kerr 413 / IATC,
Santa Cruz,CA 95064

Tel: 831.459.5415
innovation@ucsc.edu
officeofresearch.ucsc.edu/
Fax: 831.459.1658