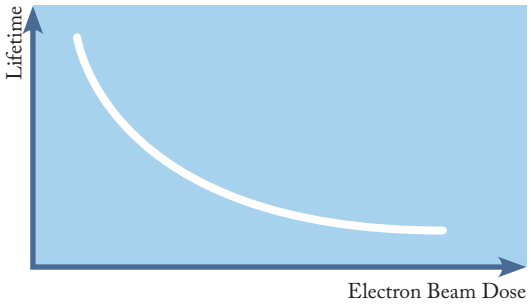
DEVICES WHICH CAN BE IMPROVED BY EBEAM PROCESSING INCLUDE:

Diodes
Thyristors
Gate Turn Off Thyristors (GTOs)
Insulated Gate Bipolar Transistors (IGBTs)
Bipolar Junction Transistors (BJTs)
Power MOSFETs (their body diodes)
PPTC's
Silicon Waffles



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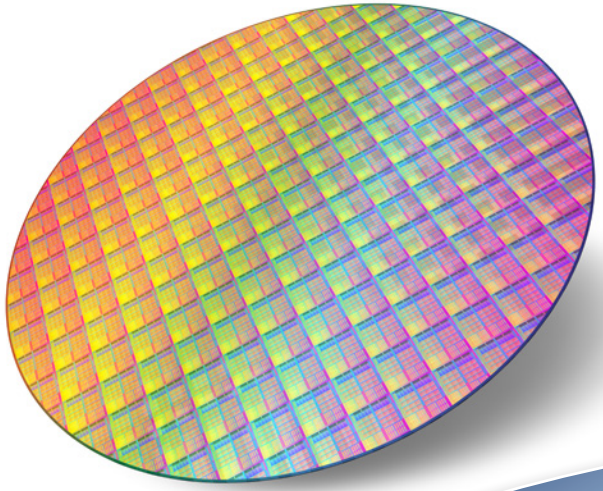
Electron Beam Processing of SEMICONDUCTORS for Precision Lifetime Control

The Global Leader In Contract Radiation Processing Services



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OVERVIEW

Electron beam processing is used as a reliable and reproducible method for tailoring switching speeds and recovery times of many silicon power semiconductor devices by reducing minority carrier lifetimes. The alternative conventional process used to control the carrier lifetime of such devices is gold or platinum doping.

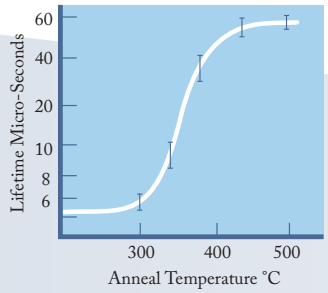
ELECTRON BEAM PROCESSING

Electron beam processing is a method of modifying materials by bombarding them with a stream of high-energy electrons. An electron beam accelerator generates a continuous beam of electrons, which is scanned (swept) across a conveyor on which the product to be processed is placed. The resulting crystal lattice disruption affects the minority carrier lifetimes of the semiconductors, which improves the switching speed. The properties of the material after treatment depend on the absorbed dose from the electron beam.

Electron beam processing, which can be performed on metallized wafers or finished devices where testing prior to and after treatment is possible, has none of the shortcomings of doping. If devices or wafers are over-treated, they can be brought back to their required or original carrier lifetime values by annealing at or above 300°C.

This is a very important feature of electron beam processing since devices annealed back to their original carrier lifetime values can be re-treated to obtain the correct value. Devices that have not reached the required carrier lifetime value can be further treated until the correct value is reached, because exposure to the electron beam process is cumulative.

Effects of Annealing after Electron Beam Processing (1800V Diodes)*



ELECTRON BEAM VS. DOPING

Electron beam processing offers some important advantages over doping:

- Electron beam is uniform and highly reproducible, whereas doping is sensitive to silicon defects that can hinder uniformity and reproducibility
- Electron beam allows the ability to electrically measure switching speed before and immediately after treatment, while doping is done too early in the manufacturing process to allow such testing.
- Electron beam is reversible, whereas doping is irreversible

ELECTRON BEAM PROCESSING FOR PRECISION MINORITY CARRIER LIFETIME REDUCTION TO ENHANCE SWITCHING SPEED…

- Ebeam simplifies device production
- Ebeam is uniform, accurate and reproducible
- Metal doping is sensitive to silicon defects that can hinder uniformity and reproducibility
- Ebeam treated materials are fully recoverable
- Ebeam is a room temperature process
- Ebeam is a “clean process” – done at the end of the wafer fabrication
- Ebeam allows the ability to measure switching speed before and after treatment