

# innovations

from The University of Vermont

**TITLE:** STRUCTURE AND METHOD FOR ABRUPT PN JUNCTION DIODE FORMED USING CHEMICAL VAPOR DEPOSITION PROCESSING

**INVENTOR:** Walter Varhue

**DESCRIPTION:** The invention relates to forming a pn junction in a semiconductor structure, and, in particular, to forming a hyper-abrupt pn junction by low-temperature growth of a doped film on a surface of an oppositely doped substrate wherein the metallurgical junction of the pn junction could coincide with the surface of the substrate. The process makes it possible to place the metallurgical junction directly at the wafer surface and permits the growth of films of any doping concentrations, including doping concentrations in which the least doped side is greater than  $10^{16}$  cm<sup>-3</sup>. The present process has been developed for use in an electron cyclotron resonance (ECR) PECVD reactor. However, the deposition conditions are also possible in other chemical vapor deposition apparatus.

**ADVANTAGES:** An advantage of the process of the present invention is its ability to produce properly functioning pn junction devices having the original wafer surface contained within the depletion region. This ability permits the diodes to be fabricated at any doping concentration, without concern for trap-assisted tunneling. This process can also be used to produce properly functioning devices having their metallurgical junctions coincident with the wafer surface. Epitaxial layers on a doped substrate can be grown at any doping concentration. The process may be performed at a lower temperatures to reduce or eliminate diffusion of dopant atoms across metallurgical junctions, while producing a hyper-abrupt pn junction.

**PATENT STATUS:** US Patent applied for 6/00

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