GaAs PD Epiwafer

Descriptions

Two- or three-inch epiwafers grown by MOVPE are available for GaAs photodiode (PD) fabrication. An epiwafer layer structure is shown in ***Figure* 1**. The top window layer can be either AlGaAs or InGaP which has larger energy band-gap than GaAs. From the structure, Zn-diffusion method is used by customers to convert the top layer material into P-type, by exposing wafers to Zn vapor through SiN defined windows. This type of photodiode is called the planar P-i-N PD. For ease of P-ohmic contact after Zn-diffusion process, a thin U-GaAs layer can be grown on top of the window layer. LandMark also provides the P-AlGaAs or P-InGaP on top of i-GaAs for etched mesa-type P-i-N PD. Also, the substrate can be Semi-Insulating (SI) type for PD array or high speed PD fabrication. ***Figure 2*** shows the schematic bird 's view and cleaved side-view of a PD chip. The GaAs PD is widely used in the Gigabit Ethernet receiver or transceiver where laser's wavelength is shorter than 870 nm.

FIG.1

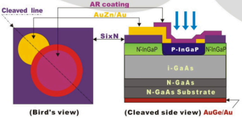

FIG.2

Wafer Characterization

Epiwafers are characterized by DCXD, Alpha-Step, PL and E-CV tests. ***Figure* 3.** Shows the X-ray rocking curve of an InGaP/GaAs PD wafer. Typically, LandMark can control the lattice mismatch of InGaP material within 500ppm with ± 150ppm uniformity across a 2-inch wafer.

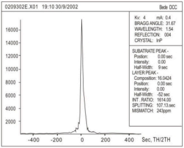

FIG.3

Wafer Characterization

Figure 4 shows the carrier concentration depth profile from GaAs/Buffer/Substrate layers. It is measured by the depletion-mode CV method. The intrinsic GaAs material has background concentration as low as 5-1.0X10^{14}cm^{-3}

The precise thickness of the top InGaP layer is necessary for customers doing Zn-diffusion. Because, where the Zn-diffusion-front position to InGaP/GaAs interface is critical for response and capacitance characteristics. Hence, LandMark provides thickness data of the layer measured by Alpha-step machine. ***Figure 5*** shows how the thickness of the layer is being measured. The sample under test had been wet-etched to reveal the InGaP to GaAs step. The probe goes trough the step and measures the thickness.

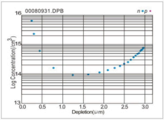

FIG.4

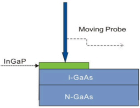

FIG.5

Typical Epitaxial Parameters

Parameters	Values
Thickness control	Better than ± 5%
Thickness uniformity	Better than ± 2% at the inner 40mm
PL Wavelength uniformity	~ 870 nm, no variation is observed
Doping control	~±20% for P-type ; ~±20% for N-type
Zn diffused P-InGaP (cm^{-3})	Zn doped;1E17 to 3E18
N-GaAs doping (cm^{-3})	Si doped, 1E17 to 5E18
P-A IGaAs doping (cm^{-3})	C doped, >1E18
U- InGaP background C.C. (Cm^{-3})	5E15~2E16
I- GaAs background C.C. (Cm^{-3})	<5E14; Minimum ~ 8E13
Defect density control (Diameter)	<50 cm^{-2}(D>10um)

Typical Device Performance

Parameter	Symbol	Typical
Dark current @ - 5V	I_d	< 100 pA
Capacitance @ - 5V	C_p	~0.65 pF
Responsivity	Res	~ 0.65 A/W (@850nm)
Break down Voltage @ 10uA	V_R	> 20 V
Serial resistance	Rs	<50 Ω
Good device yield	--	> 80%
Zn diffused, planar type PiN	100 um aperture	