

High Grade Epi Specification

Items	Specification	Tolerance	Typical	Remark
Diameter	6"(150mm)	-	-	
Poly-type	4H	-	-	
Surface	(0001)Si-face	-	-	
Off-orientation	4deg-off	-	-	
Conductivity	n-type	-	-	
Dopant	Nitrogen	-	-	
Carrier Concentration	1E15-3E16	±12%~±15%	±8%	All Meas, points
Epi Thickness	5um~30um	±8%~±10%	±6%	All Meas, points
PDD	≤2.0/cm ²	-	0.3/cm ²	(THK5um~30um)
BPD 2mm yield	>92%	-	98%	Up to request

Notes

1) Other dimensional specifications are similar to definition in SEMI M12

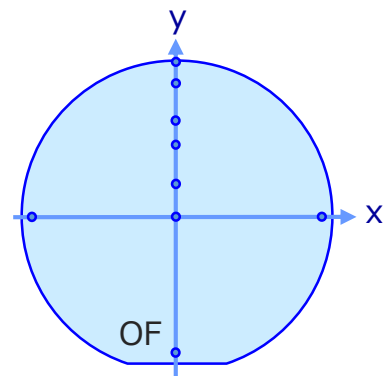
2) Measurement points for Thickness and Carrier Concentration

15mm pitch 9pts (EE = 4mm)

Thickness by FT-IR

Carrier Concentration by Hg-CV

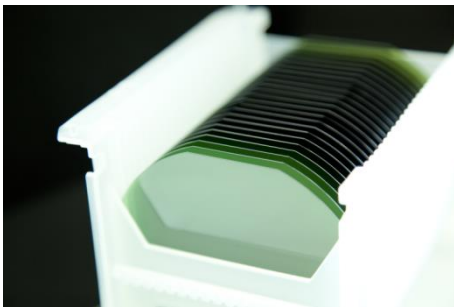
3) 8in; to be discussed



2nd Generation High Grade Epi

	High-Grade Epi (HGE)	2 nd Generation High-Grade Epi (HGE-2G)
<p>【Improvement on defects】</p> <p>Ratios of successful formulation of 10mm square chips</p>	<p>Ratio of good chips: 74%</p> <p>■ Bad chips</p>	<p>Ratio of good chips: 94%</p> <p>■ Bad chips</p>
<p>【Reduction in BPD】</p> <p>X-ray topographical image of mother plate</p> <p>BPD density: More than 5,000/cm² BPDs are in red</p>	<p>After epitaxialization (PL-NIR)</p> <p>About 4 BPDs/cm²</p>	<p>After epitaxialization (PL-NIR)</p> <p>About 0.1 BPDs/cm²</p>

6inch n-type Epi (10um thickness)



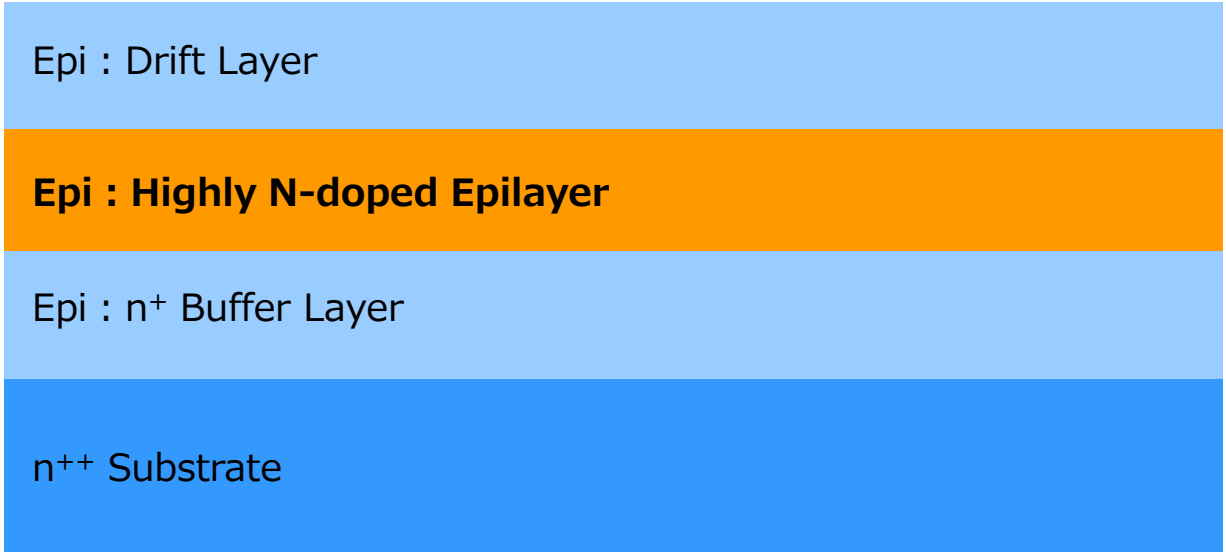
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Highly N-doped Epi layer (HNDE)

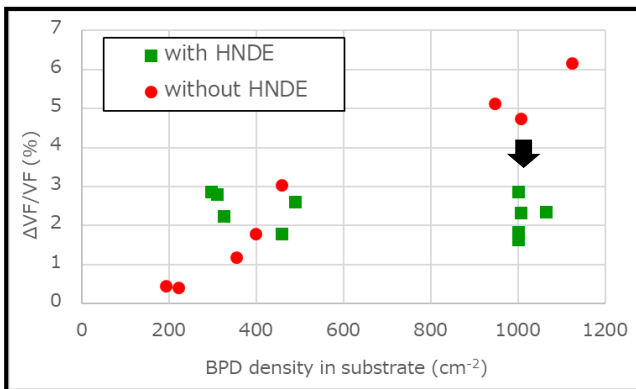


Restraint of BPD expansion by remaining minority carrier due to shorter carrier life time using highly HNDE.

※Tawara, et al Mater. Sci Forum 897 (2017) 419.

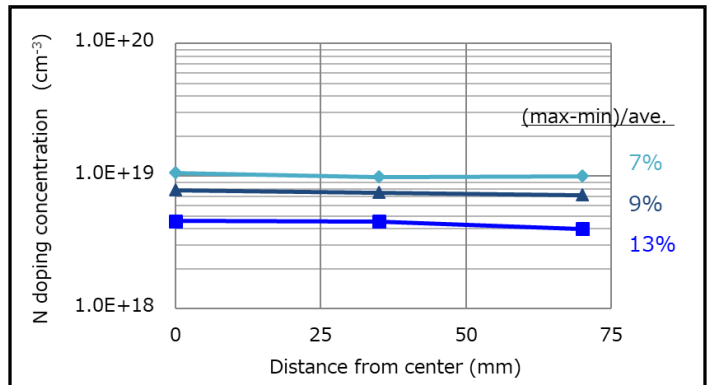
V_f shift of PiN diodes

As function of BPD density in substrate



※after application of 960 A/cm²

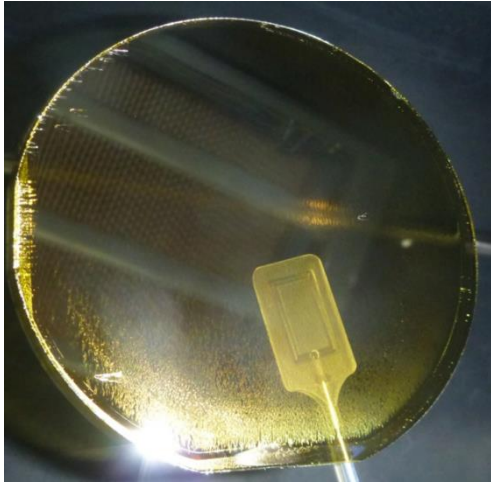
N doping uniformity on 150mm wafer



※SIMS data

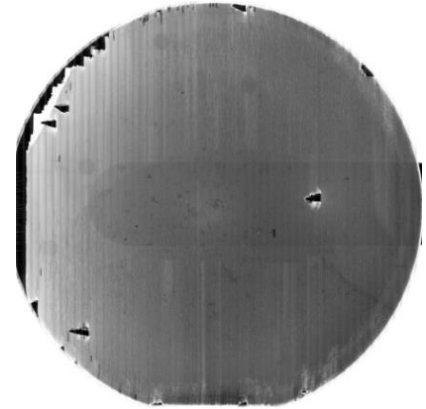
Thick epi performance

n-type ~280um thickness



on 4in wafer

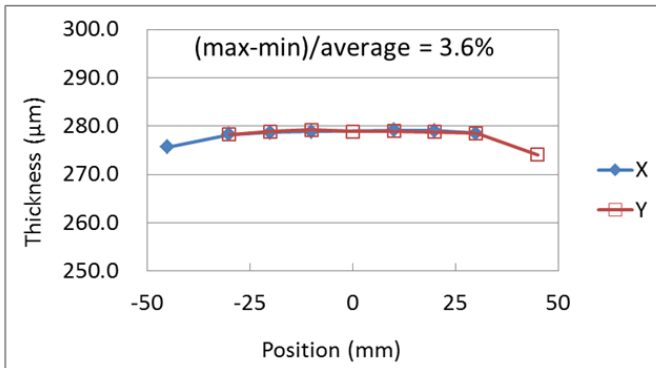
PL measurement



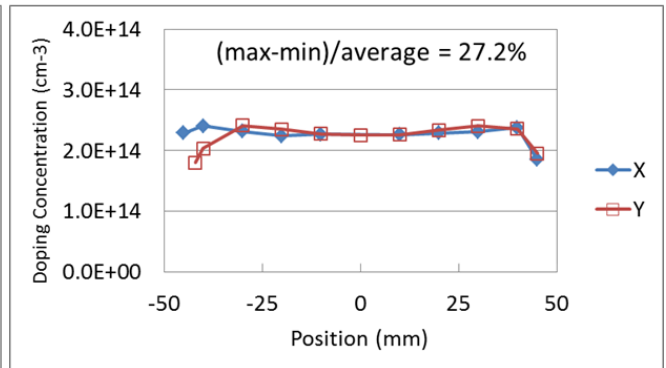
Only one triangle defect can be detected by visual

No BPD propagated from the substrate

Thickness



Carrier Concentration



*) FTIR thickness evaluation can not be applied at very out side area ($\geq 40\text{mm}$)

Thicker layer sample shows good distribution on layer thickness and carrier concentration. Surface defect and BPD performance are also improved significantly even with 280um of thickness.