



TEST REPORT

Delivery Date: October 22 2015

2"1310nm FP LD Epiwafer

(#1112261-1F)

Customer : 財團法人成大研究發展基金會

Customer : 成大研究發展基金會

Control No. : 1112261-1F

Test data : (2pcs)

1. DCXD

Item	Wafer No.	Spec (Å)	("0,12.7"mm)	("0,0"mm)	("0,-12.7"mm)	(" -12.7,0"mm)	("12.7,0"mm)
1	L2LDA1510153D	135(±5%)	~133.14	~132.61	~133.04	~133.32	~133.16
2	L2LDA1510161E		~135.5	~135.06	~135.73	~135.94	~135.46

2. PL

Item	Run No.	Spec (nm)	test (nm)
1	L2LDA1510153	1284±7.5	1283.6
2	L2LDA1510161		1285.6

3. ECV

Item	Run No.	Layer #1 (N-InP) (unit:10 ¹⁸ cm ⁻³)		Layer #9 (P-InP) (unit:10 ¹⁸ cm ⁻³)		Layer #12 (P-InGaAs) (unit:10 ¹⁹ cm ⁻³)	
		Spec.(±20%)	test	Spec.	test	Spec.	test
1	L2LDA1510153	1	~0.88	1~2	~1.62	>1	~2.3
2	L2LDA1510161		~0.92		~1.6		~2.19

4. Thickness

Item	Run No.	Layer #9 (P-InP) (unit:um)	
		Spec.(±10%)	test
1	L2LDA1510153	1.6	1.6
2	L2LDA1510161		1.59

Comment :

The lattice mismatch and QW periods had determined by QC200 Diffractometer. The BIO-RAD RPM2000 PL mode is used to measure the wavelength. The concentrations of N-InP, P-InP and P -InGaAs layers are measured by Electro-Chemical C-V Profile. The P-InP layer thickness are measured by Alpha-step.

All wafers are tested under the same criteria. The attached graphs are the prototype of the testing results. All test results are in accordance with customer's specifications.

Signature :

Reported By:

薛仁豪

Manager:

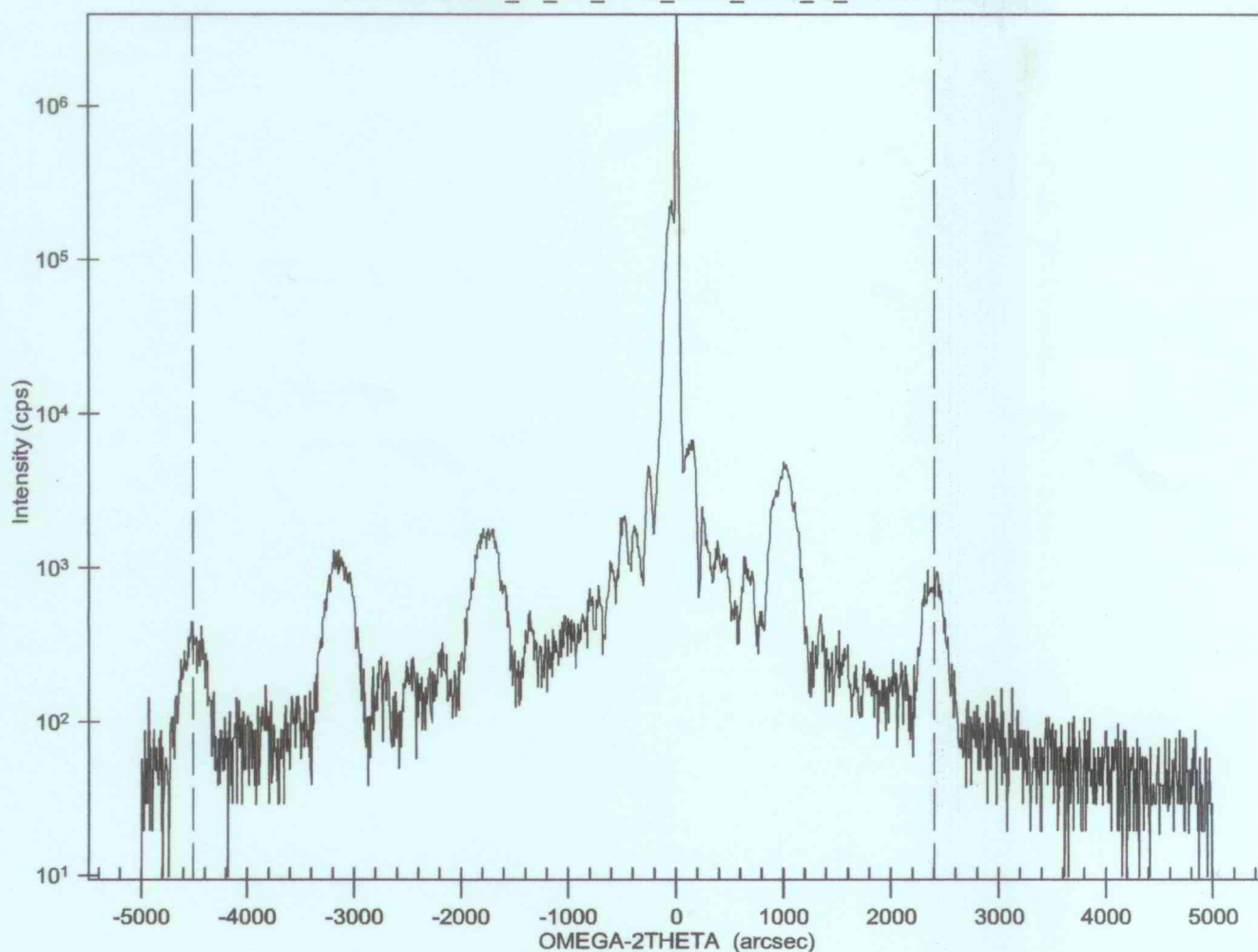
王智德

Supervisor:

王智德

Fringe Thickness Analysis

L2LDA1510161E_04_InP_0.000_0.000_0.000_%_01aa001.X01



Substrate: InP

Epilayer: -

Average Fringe Spacing: 1382.17 arcsec

Thickness: 135.06 Å

Fringe Thickness

ID: L2LDA1510161E_04_InP_0.000_0.000_0.000_%_01aa001.X01

h,k,l: (0,0,4)

Number of Fringes: 5

ACCENT RPM2000

Date : October 16, 2015 18:49:32 Operator :
Wafer ID : L2LDA1510161C-QW Batch ID :
Material : InP Thickness : 350 μ m
Filename : C:\Data\2015\L2LDA\1510161\L2LDA1510161C-QW.spl
Description :
Recipe :

Scan parameters

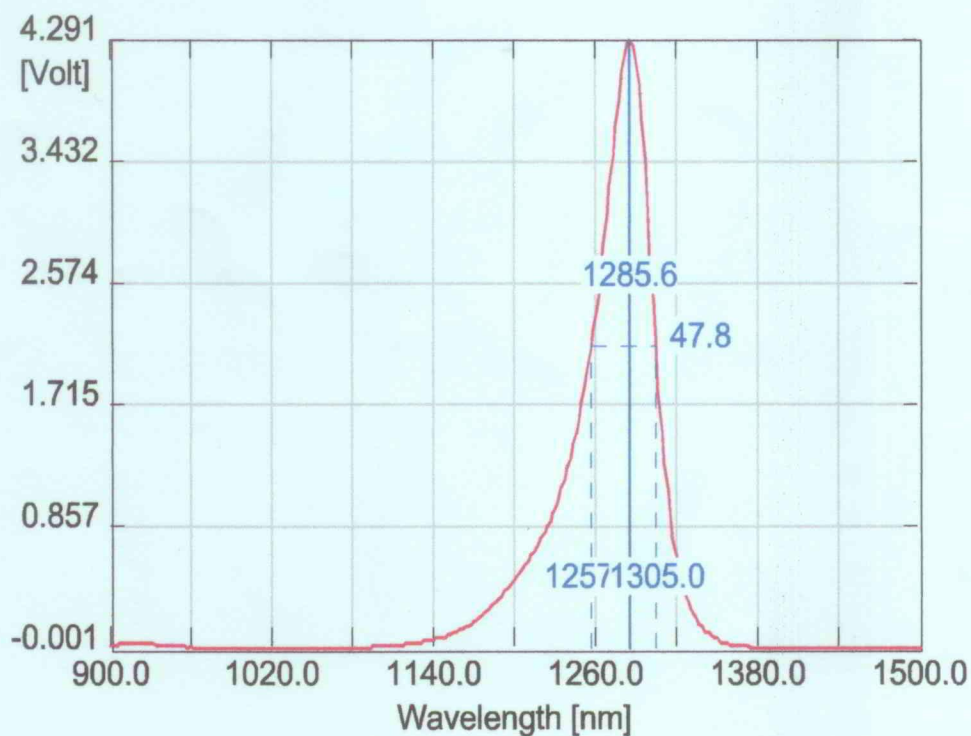
X : 0.0 mm
Y : 0.0 mm
Scan rate : 100 pts/s
Temperature : 22.5 C

Wavelength settings

Range : 900.3 to 1530.9 nm
Slit width : 0.500 mm
Grating : 150g/mm-1250
Detector : InGaAs
Gain : x1 (corr.)
Filter : 570nm HP
Calibration : N/A

Laser parameters

Name : 532nm CW 10mW
Wavelength : 532.0 nm
Power : 5.3 mW



Analysis Parameters

Mode : Custom 2
Min Limit : 900.0 nm
Max Limit : 1500.0 nm
Threshold : 97.0 %
FWHM : 50.0 %

Results

Peak : 1285.6 nm
Height : 4.291 Volt
FWHM : 47.8 nm
Area : 126 a.u.

Nanometrics RPM

Date : October 16, 2015 01:52:24
 Wafer ID : L2LDA1510153D
 Material : InP
 Filename : \\Qcstore\\measure\\PL2000-1064\\2015\\2lda\\1510153\\L2LDA1510153D.spm
 Description :
 Recipe : 1112261-1f.rcf
 Calibration : (none)

Operator :
 Batch ID :
 Thickness : 350 痠

Scan parameters

Wafer size : 50.8 mm
 Scan diameter : 50.0 mm
 Resolution : 1.0 mm
 Scan rate : 30 pts/s
 Temperature : 23.3 C
 Smoothed : No

Wavelength settings

Center : 1283.7 nm
 Range : 1150.4 to 1419.0 nm
 Resolution : 2.10 nm/pixel (128)
 Slit width : 0.500 mm
 Grating : 150g/mm-125
 Detector : InGaAs-256
 Gain : x1 (corr.)
 Filter : 1100HP-new

Analysis Parameters

Mode : Custom 2
 FFT Filter : No
 Min Limit : 1150.0 nm
 Max Limit : 1420.0 nm
 Threshold : 97.0 %
 FWHM : 50.0 %

Laser parameters

Name : 1064nmNd:YAG
 Wavelength : 1064.0 nm
 Power : 15.7 mW
 Pow Density : 200.3 W/cm2

Statistics

Average : 1281.0 nm
 Std dev : 3.852 nm
 (0.301 %)
 Median : 1282.0 nm
 Min : 1265.8 nm
 Max : 1285.9 nm
 10% cutoff : 1276.3 nm
 25% cutoff : 1280.2 nm
 75% cutoff : 1283.5 nm
 90% cutoff : 1284.2 nm
 Exc. zone : 3.0 nm

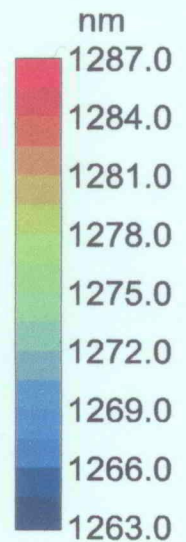
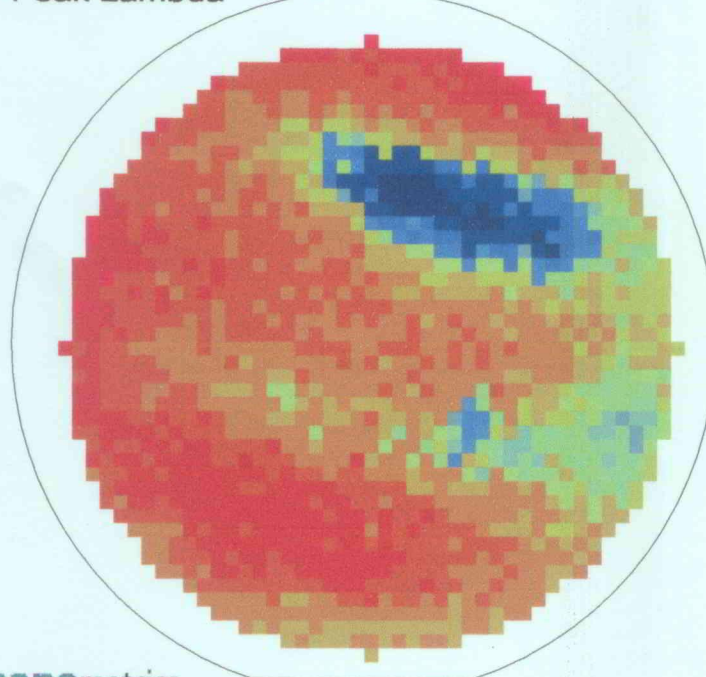
Thresholds :

Upper Lmt : 1350.0 nm
 Lower Lmt : 1100.0 nm

Specifications

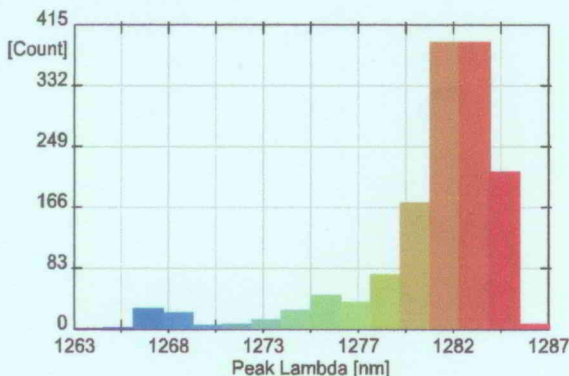
Upper Lmt : 1291.5 nm
 Lower Lmt : 1276.5 nm
 In-Spec : 85.76 %
 Below : 14.24 %
 Above : 0.00 %

Peak Lambda



nanometrics

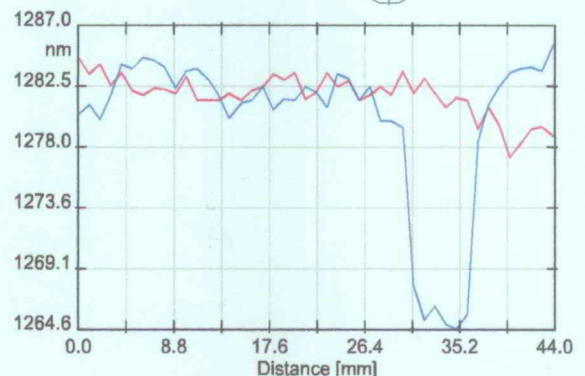
Peak Lambda Histogram



Max count : 394 at 1283.3 nm
 Bin size : 1.5 nm

Mean : 1281.0 nm
 Median : 1282.0 nm

Peak Lambda Profile



22.0, 270.0 to 22.0, 90.0 [mm, deg] 22.0, 0.0 to 22.0, 180.0 [mm, deg]
 Average : 1281.9 nm Average : 1280.1 nm
 Ave Dev: 1.1 nm (0.1 %) Ave Dev: 3.9 nm (0.3 %)
 Min : 1277.3 nm Min : 1264.6 nm
 Max : 1284.7 nm Max : 1285.7 nm

Nanometrics RPM

Date : October 16, 2015 18:30:59 Operator :
 Wafer ID : L2LDA1510161E Batch ID :
 Material : InP Thickness : 350 痠
 Filename : \\Qcstore\\measure\\PL2000-1064\\2015\\2lda\\1510161\\L2LDA1510161E.spm
 Description :
 Recipe : 1112261-1f.rcf
 Calibration : (none)

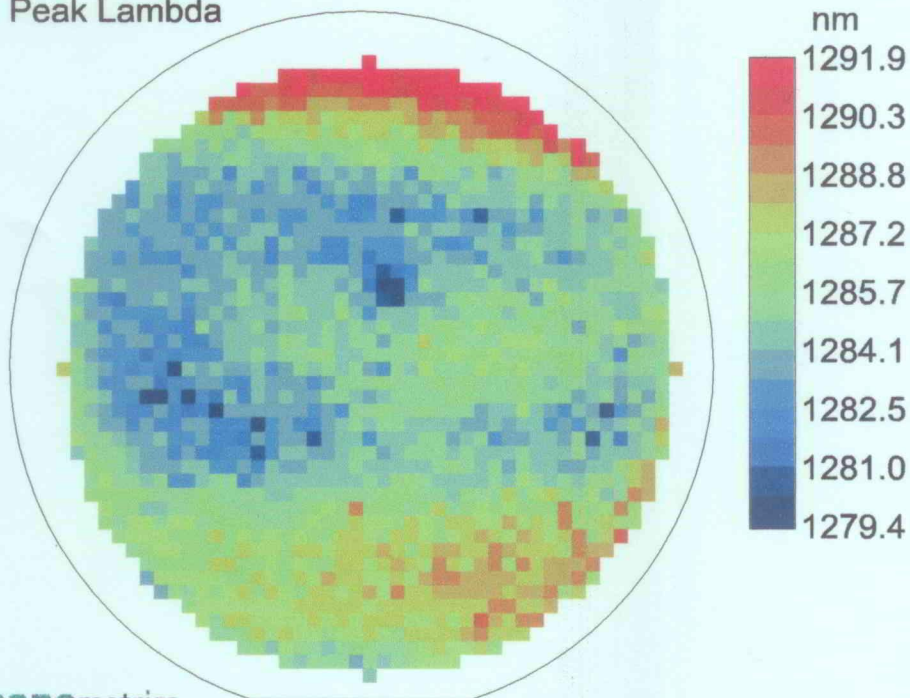
Scan parameters	Wavelength settings	Analysis Parameters	Laser parameters
Wafer size : 50.8 mm	Center : 1283.7 nm	Mode : Custom 2	Name : 1064nmNd:YAG
Scan diameter : 50.0 mm	Range : 1150.4 to 1419.0 nm	FFT Filter : No	Wavelength : 1064.0 nm
Resolution : 1.0 mm	Resolution : 2.10 nm/pixel (128)	Min Limit : 1150.0 nm	Power : 16.5 mW
Scan rate : 30 pts/s	Slit width : 0.500 mm	Max Limit : 1420.0 nm	Pow Density : 210.7 W/cm2
Temperature : 22.8 C	Grating : 150g/mm-125	Threshold : 97.0 %	
Smoothed : No	Detector : InGaAs-256	FWHM : 50.0 %	
	Gain : x1 (corr.)		
	Filter : 1100HP-new		

Statistics
 Average : 1285.3 nm
 Std dev : 1.977 nm
 (0.154 %)
 Median : 1285.1 nm
 Min : 1279.0 nm
 Max : 1291.8 nm
 10% cutoff : 1283.1 nm
 25% cutoff : 1283.9 nm
 75% cutoff : 1286.5 nm
 90% cutoff : 1287.9 nm
 Exc. zone : 3.0 mm

Thresholds :
 Upper Lmt : 1350.0 nm
 Lower Lmt : 1100.0 nm

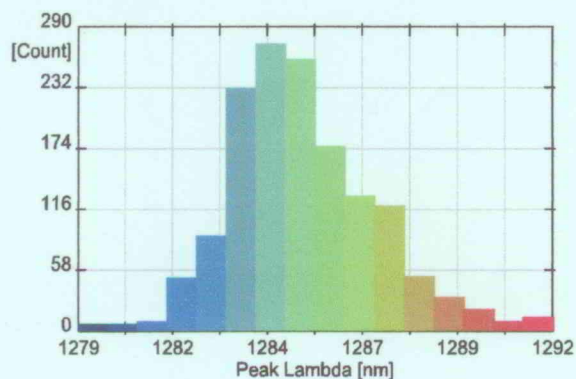
Specifications
 Upper Lmt : 1291.5 nm
 Lower Lmt : 1276.5 nm
 In-Spec : 98.35 %
 Below : 0.00 %
 Above : 1.65 %

Peak Lambda



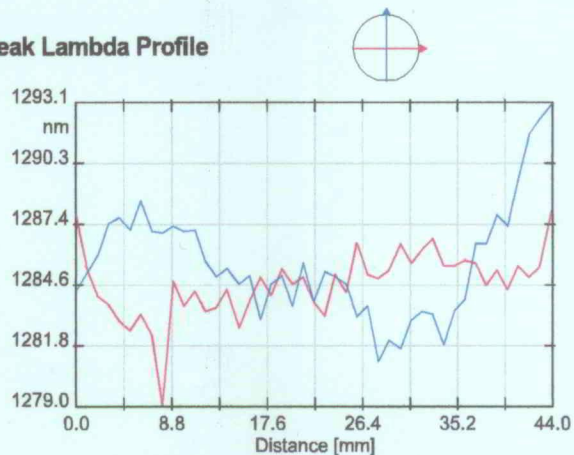
nanometrics

Peak Lambda Histogram

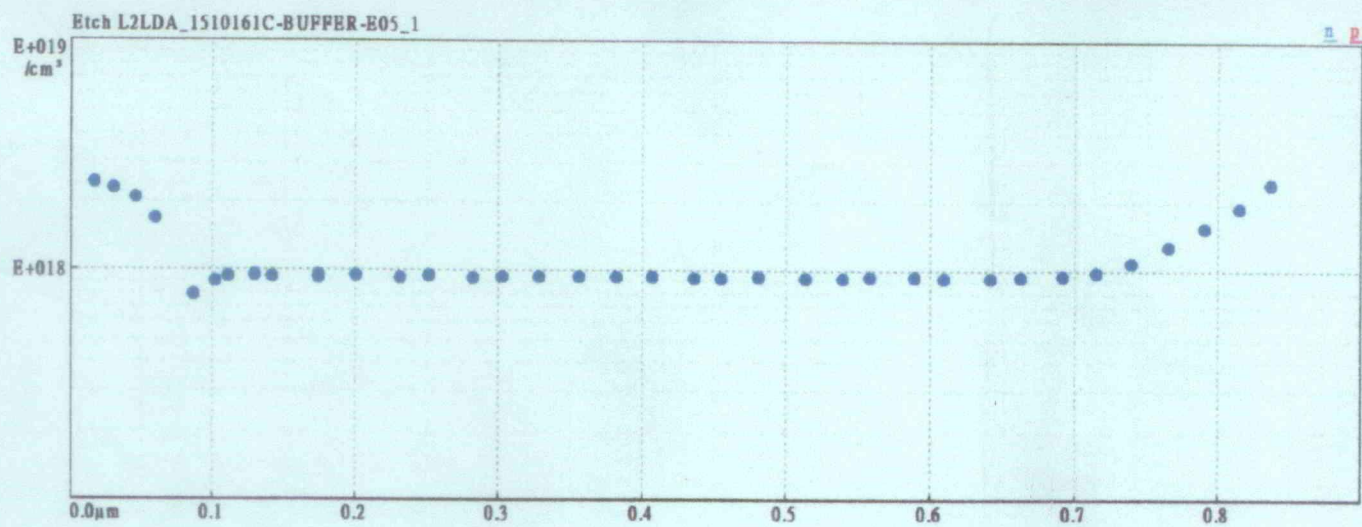


Max count : 275 at 1284.5 nm Mean : 1285.3 nm
 Bin size : 0.8 nm Median : 1285.1 nm

Peak Lambda Profile

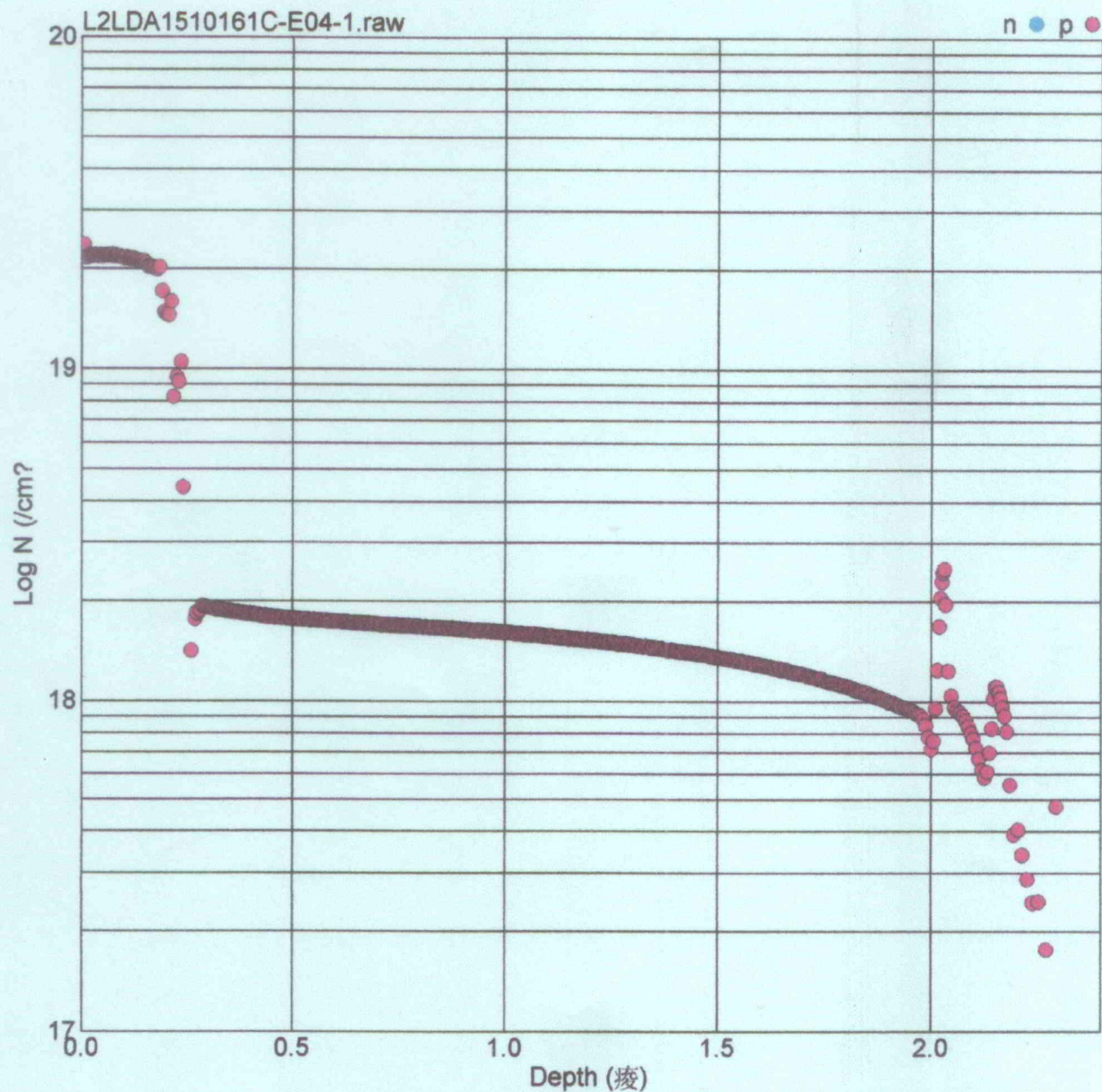


22.0, 270.0 to 22.0, 90.0 [mm, deg]	22.0, 0.0 to 22.0, 180.0 [mm, deg]
Average : 1284.7 nm	Average : 1285.7 nm
Avge Dev: 1.1 nm (0.1 %)	Avge Dev: 2.0 nm (0.2 %)
Min : 1279.0 nm	Min : 1281.1 nm
Max : 1288.1 nm	Max : 1293.1 nm

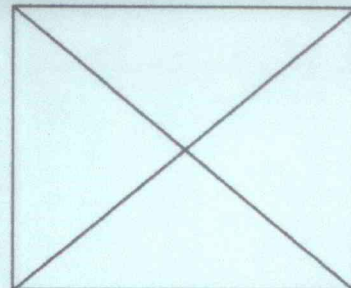


Layer#1(N- InP)

Reg End Mat1 +% Mat2 model EAC freq A-wet A-ill
 1 48 InAs 47 GaAs Parall Off 7.46789385223370717400000000000000000000e+174 0.0076 0.0095
 2 414 InP 0 GaAs Parall Off 7.46789385223370717400000000000000000000e+174 0.0076 0.0095



Layer#12(P- InGaAs)+Layer#9(P- InP)

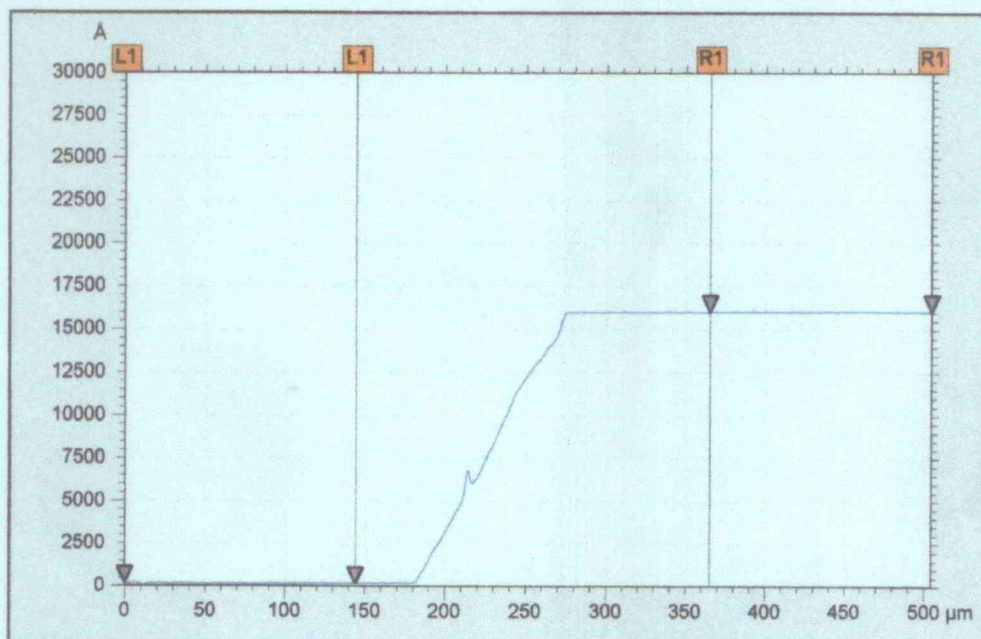


Document name: L2LDA1510161C-1

<input checked="" type="checkbox"/>		Levelled (2 bars)
<input type="checkbox"/>		Form removing: Deactivated
<input type="checkbox"/>		Zooming: Deactivated

	Set1
StpHt	15906 A

Parameter	Automatic	2 zones
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聯亞光電工業股份有限公司

Land Mark Optoelectronic Corporation

規格需求表

(SPECIFICATIONS CONFORMATION)

(LM-WORKP-DC-T1)

1. 功能模式來源： ☐ 契約 ☒ 訂單 ☐ 年度營運計畫書
(Order Type)

2. 功能簡述：

(Function Description)

2" 1310nm FP LD Epiwafer

3. 相關法令、規章(附件) (Local Regulations for the Products Specified)：無 (None)

4. 制定者：聯亞光電
(Specified By)

5. 制定日期：2015/03/09
(Date of Specification)

6. 規格制定 (Specifications)：

序號 (No.)	規格需求項目 (Item Name)	規格值 (Value for Customer)	單位 (Unit)	誤差 (DP)	工作條件 (Test Condition)	備註 (Note)
0	Substrates are provided by Customer	---	---	---	---	2" wafer
1	N-InP Buffer Layer, (Concentration)	0.8 (1×10^{18})	μm (cm^{-3})	$\pm 10\%$ ($\pm 20\%$)	C-V Test	On test wafer
2	N-In _{0.52} Al _{0.48} As ($\lambda_g=829.2\text{nm}$) (Concentration)	0.05 ($2-0.8 \times 10^{18}$)	μm (cm^{-3})	$\pm 10\%$ (---)	---	---
3	N-GRIN-InAlGaAs (Al=0.38 to 0.35, $\lambda_g=960.4$ to 1000nm) (Concentration)	0.05 ($0.5-1 \times 10^{18}$)	μm (cm^{-3})	$\pm 10\%$ (---)	---	---
4	MQW (λ_{pl})	13.5 (1284)	nm (nm)	$\pm 5\%$ (± 7.5)	DCXD&PL measurement	On epi-wafer On test wafer
5	U-GRIN-InAlGaAs (Al=0.35 to 0.38, $\lambda_g=1000$ to 960.4nm)	0.05	μm	$\pm 10\%$	---	---
6	U-In _{0.52} Al _{0.48} As ($\lambda_g=829.2\text{nm}$)	0.05	μm	$\pm 10\%$	---	---
7	P-InP (Concentration)	0.1 (5×10^{17})	μm (cm^{-3})	$\pm 5\%$ ($\pm 20\%$)	---	---
8	P-1.15 μm InGaAsP (Concentration)	0.015 (1×10^{18})	μm (cm^{-3})	$\pm 5\%$ ($\pm 20\%$)	---	---
9	P-InP Cladding Layer, (Concentration)	1.6 ($1-2 \times 10^{18}$)	μm (cm^{-3})	$\pm 10\%$ (---)	C-V Test	On test wafer
10	P-1.3 μm PQ Layer, (Concentration)	0.025 ($>3 \times 10^{18}$)	μm (cm^{-3})	$\pm 10\%$ (---)	---	---
11	P-1.52 μm PQ Layer, (Concentration)	0.025 ($>3 \times 10^{18}$)	μm (cm^{-3})	$\pm 10\%$ (---)	---	---
12	P-InGaAs Layer, (Concentration)	0.2 ($>1 \times 10^{19}$)	μm (cm^{-3})	$\pm 10\%$ (---)	C-V Test	On test wafer

Note: 1. Test report 須提供每片 PL mapping data

2. Test report 須提供每片 5 點 X-Ray data (12.7mm away from center)

3. No guarantee for surface morphology.

4. The out-diffusion of dopant can't be avoided. The doping profile will not be guaranteed.

7. 製作者： 林美玲
(R&D Manager)

8. 主管： 林菊
(Supervisor)

9. 需求者/客戶簽認： 文莊
(Customer Confirmation) (signature)

公司名稱： 成大研究發展基金會
(Customer)

10. 管制碼： 規需 1112261-1F (Control No.)

(Please mail back after the confirmation signature by manager who make this order)

保存年限： 7 年

密等： 密

Page : 1