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.

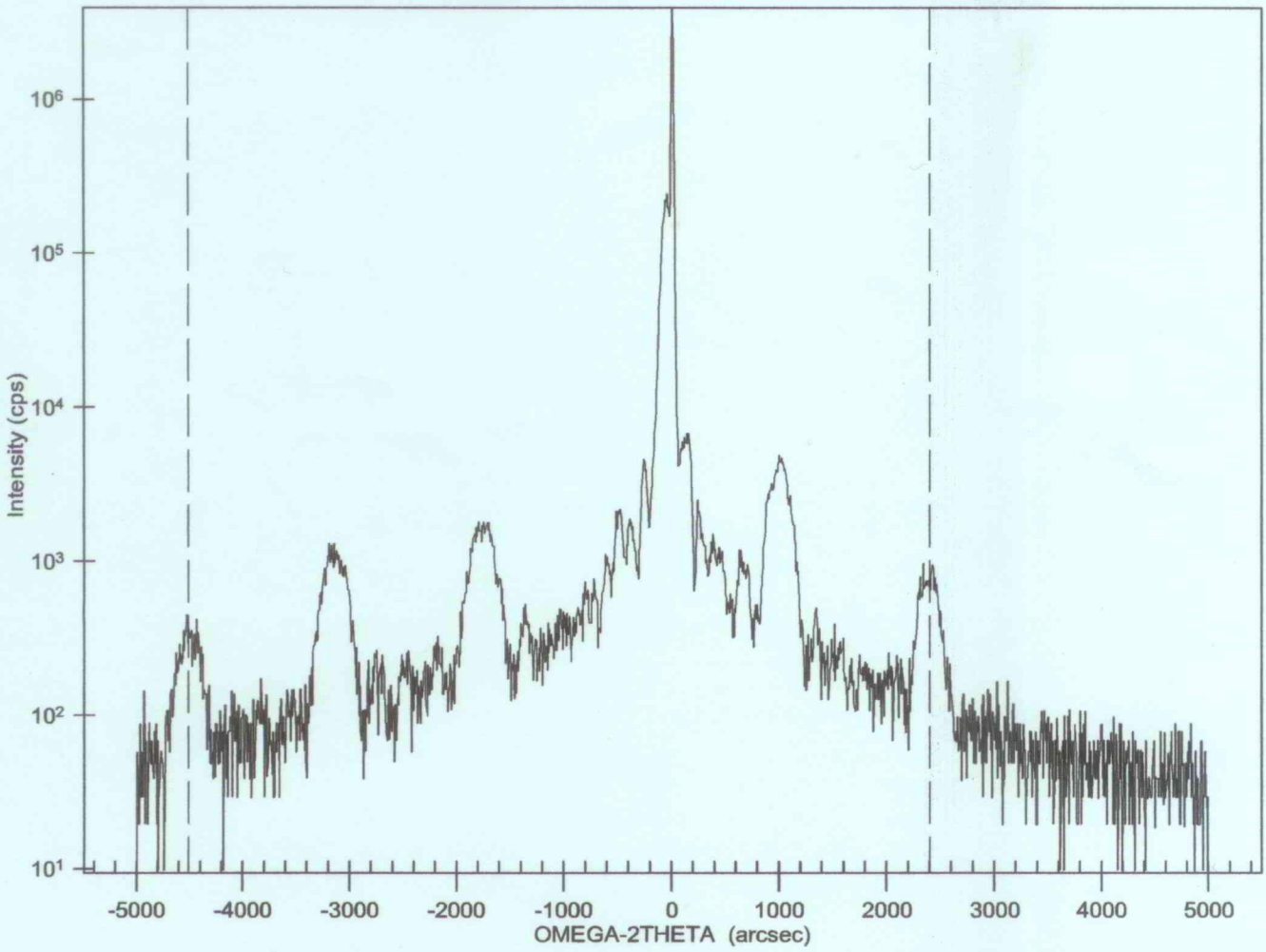
All wafers are tested under the same criteria. The attached graphs are the prototype of the testing results. All test results are in accordance with customer's specifications.

Signature：

Reported By: 莫仁豪 Manager: 王翊儒代 Supervisor:

Fringe Thickness Analysis

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



Fringe Thickness

Substrate: InP
Epilayer: -
Average Fringe Spacing: 1382.17 arcsec
Thickness: 135.06 Å

ID: L2LDA1510161E_04_InP_0.000_0.000_0.000_%_01aa001.X01
h,k,l: (0,0,4)
Number of Fringes: 5

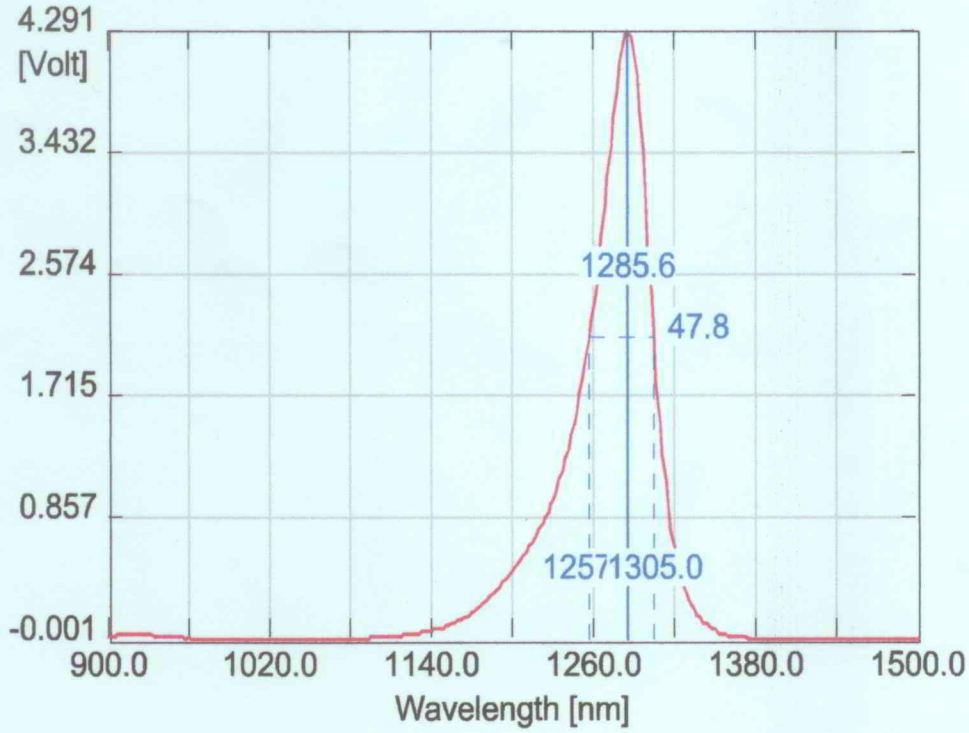
ACCENT RPM2000

Date	: October 16, 2015 18:49:32	Operator	:
Wafer ID	: L2LDA1510161C-QW	Batch ID	:
Material	: InP	Thickness	: 350 µm
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\l2lda\1510153\L2LDA1510153D.spm
Description :
Recipe : 1112261-1f.rcf
Calibration : (none)

Operator :
Batch ID :
Thickness : 350 掖

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

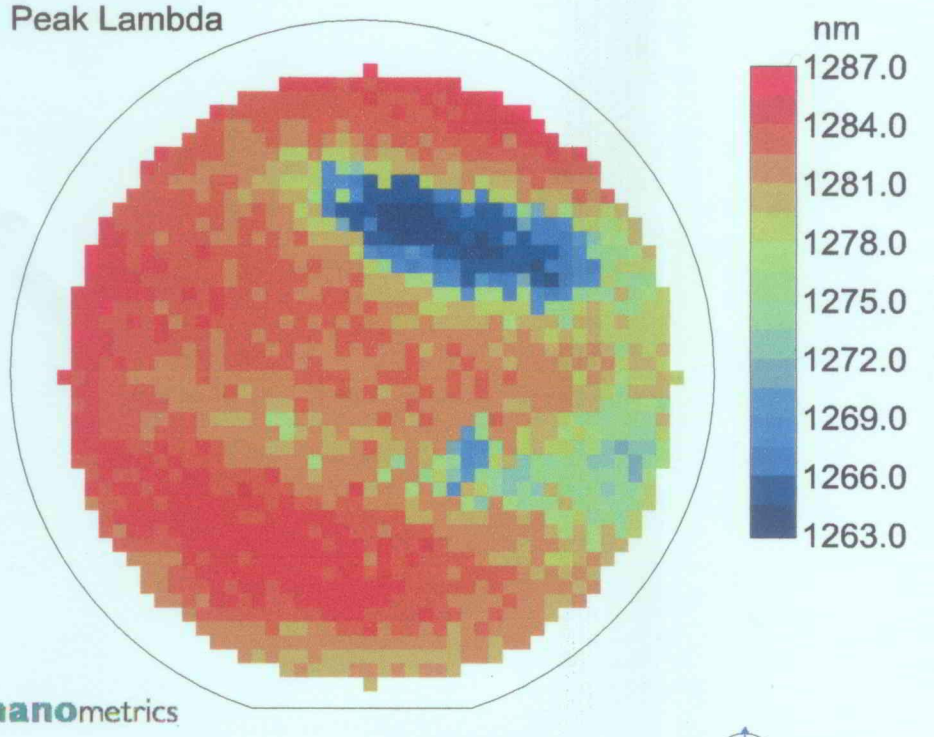
Analysis Parameters
Mode : Custom 2
FFT Filter : No
Min Limit : 1150.0 nm
Max Limit : 1420.0 nm
Threshold : 97.0 %
FWHM : 50.0 %

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

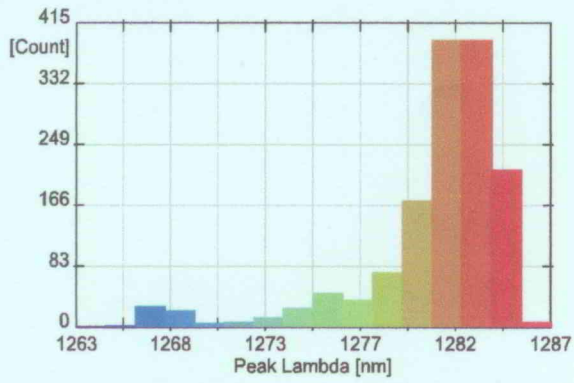
Statistics
Average : 1281.0 nm
Std dev : 3.852 nm (0.301 %)
Median : 1282.0 nm
Min : 1265.8 nm
Max : 1285.9 nm
10% cutoff : 1276.3 nm
25% cutoff : 1280.2 nm
75% cutoff : 1283.5 nm
90% cutoff : 1284.2 nm
Exc. zone : 3.0 mm

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

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

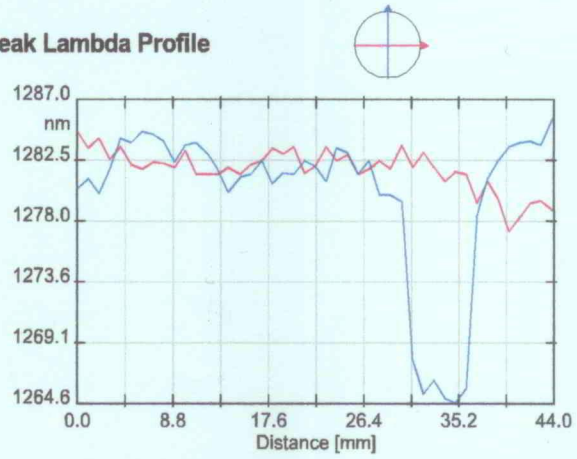


Peak Lambda Histogram



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]
Average : 1281.9 nm
Avge Dev: 1.1 nm (0.1 %)
Min : 1277.3 nm
Max : 1284.7 nm

22.0, 0.0 to 22.0, 180.0 [mm, deg]
Average : 1280.1 nm
Avge Dev: 3.9 nm (0.3 %)
Min : 1264.6 nm
Max : 1285.7 nm

Nanometrics RPM

Date : October 16, 2015 18:30:59
Wafer ID : L2LDA1510161E
Material : InP
Filename : \\Qcstore\measure\PL2000-1064\2015\l2lda\1510161\L2LDA1510161E.spm
Description :
Recipe : 1112261-1f.rcf
Calibration : (none)

Operator :
Batch ID :
Thickness : 350 掖

Scan parameters
Wafer size : 50.8 mm
Scan diameter : 50.0 mm
Resolution : 1.0 mm
Scan rate : 30 pts/s
Temperature : 22.8 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

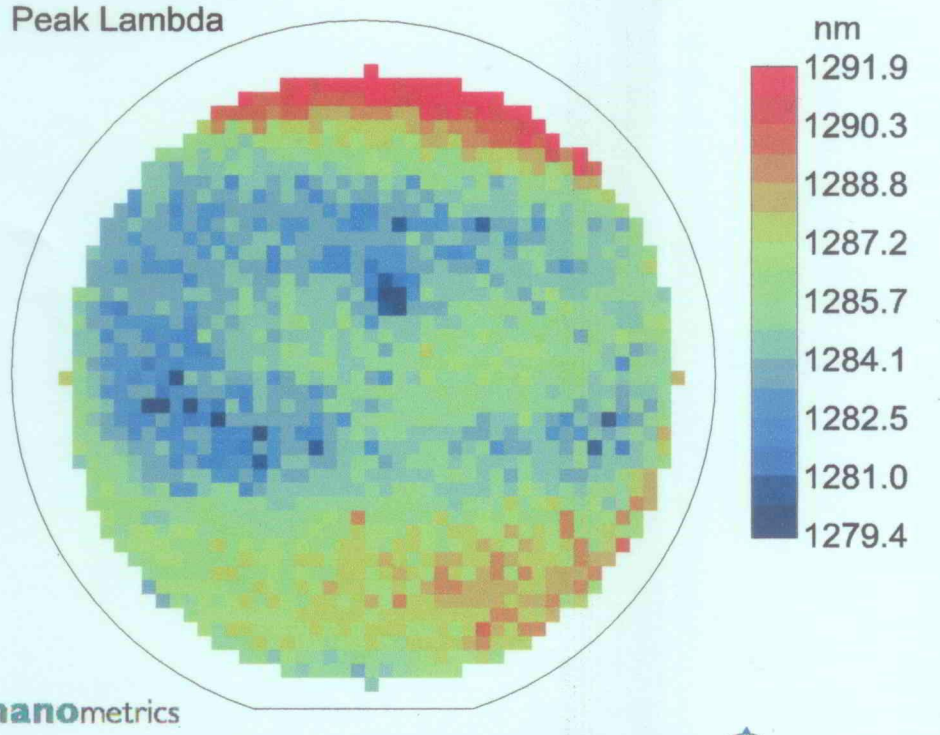
Analysis Parameters
Mode : Custom 2
FFT Filter : No
Min Limit : 1150.0 nm
Max Limit : 1420.0 nm
Threshold : 97.0 %
FWHM : 50.0 %

Laser parameters
Name : 1064nmNd:YAG
Wavelength : 1064.0 nm
Power : 16.5 mW
Pow Density : 210.7 W/cm2

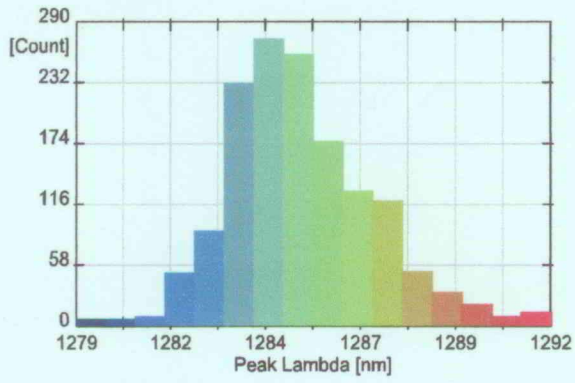
Statistics
Average : 1285.3 nm
Std dev : 1.977 nm (0.154 %)
Median : 1285.1 nm
Min : 1279.0 nm
Max : 1291.8 nm
10% cutoff : 1283.1 nm
25% cutoff : 1283.9 nm
75% cutoff : 1286.5 nm
90% cutoff : 1287.9 nm
Exc. zone : 3.0 mm

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 %

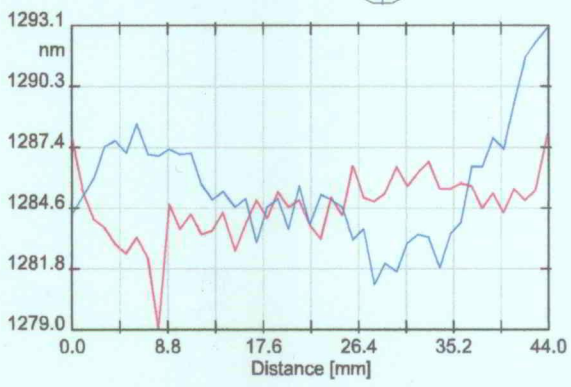


Peak Lambda Histogram



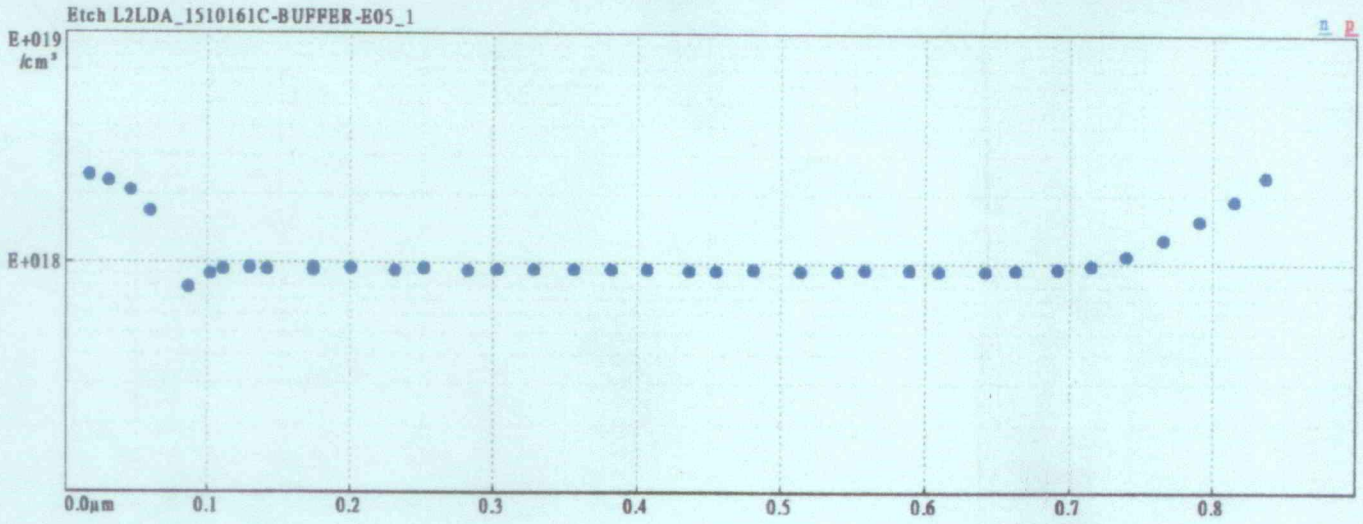
Max count : 275 at 1284.5 nm
Bin size : 0.8 nm
Mean : 1285.3 nm
Median : 1285.1 nm

Peak Lambda Profile



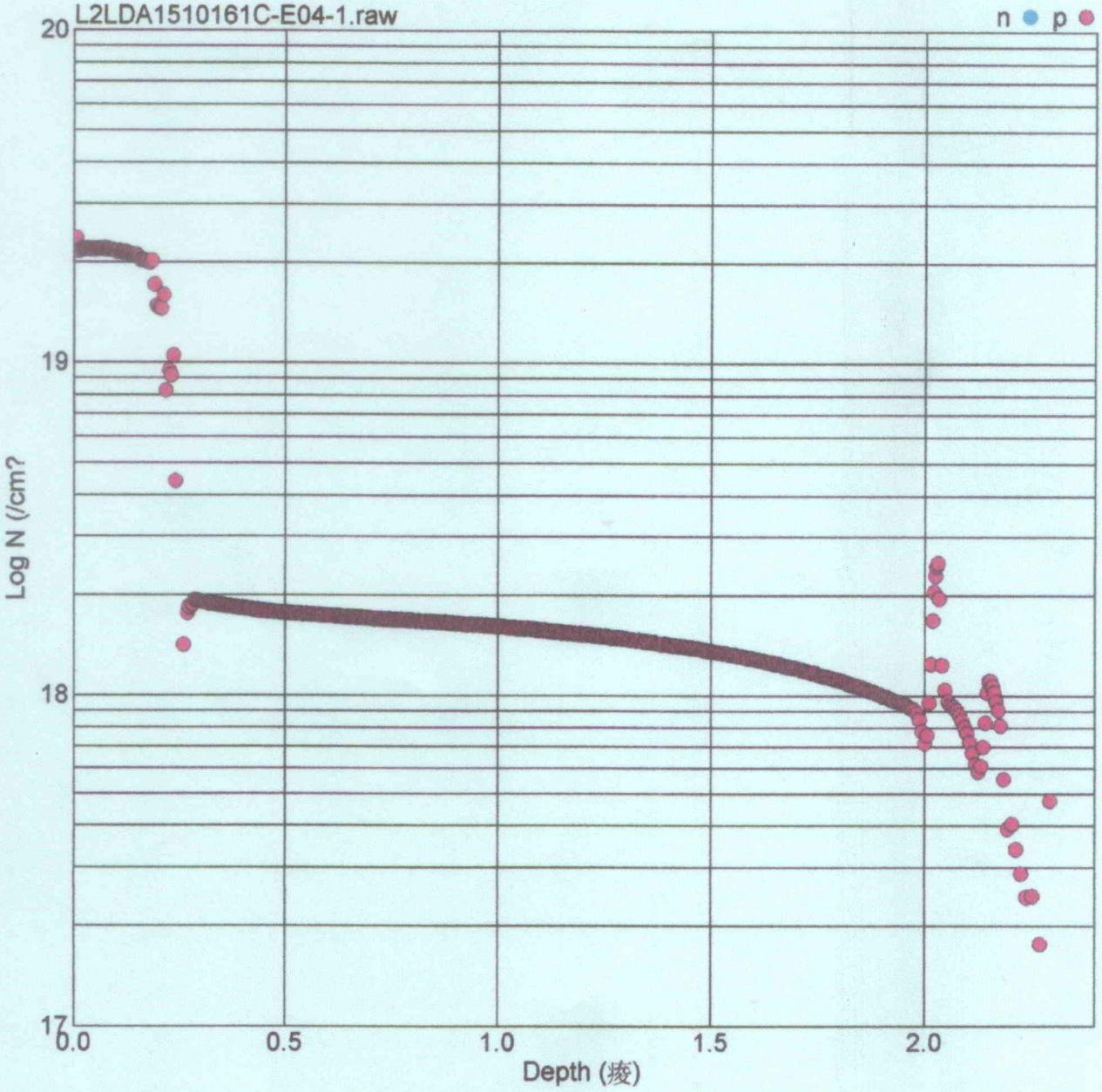
22.0, 270.0 to 22.0, 90.0 [mm, deg]
Average : 1284.7 nm
Avge Dev: 1.1 nm (0.1 %)
Min : 1279.0 nm
Max : 1288.1 nm

22.0, 0.0 to 22.0, 180.0 [mm, deg]
Average : 1285.7 nm
Avge Dev: 2.0 nm (0.2 %)
Min : 1281.1 nm
Max : 1293.1 nm


Etch L2LDA_1510161C-BUFFER-E05_1
n p
E+019
/cm³
E+018
0.0µm
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8

Layer#1(N- InP)

Reg End Mat1 +% Mat2 model EAC freq A-wet A-ill
1 48 InAs 47 GaAs Parall Off 7.467893852233707174000000000000000000000e+174 0.0076 0.0095
2 414 InP 0 GaAs Parall Off 7.467893852233707174000000000000000000000e+174 0.0076 0.0095



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

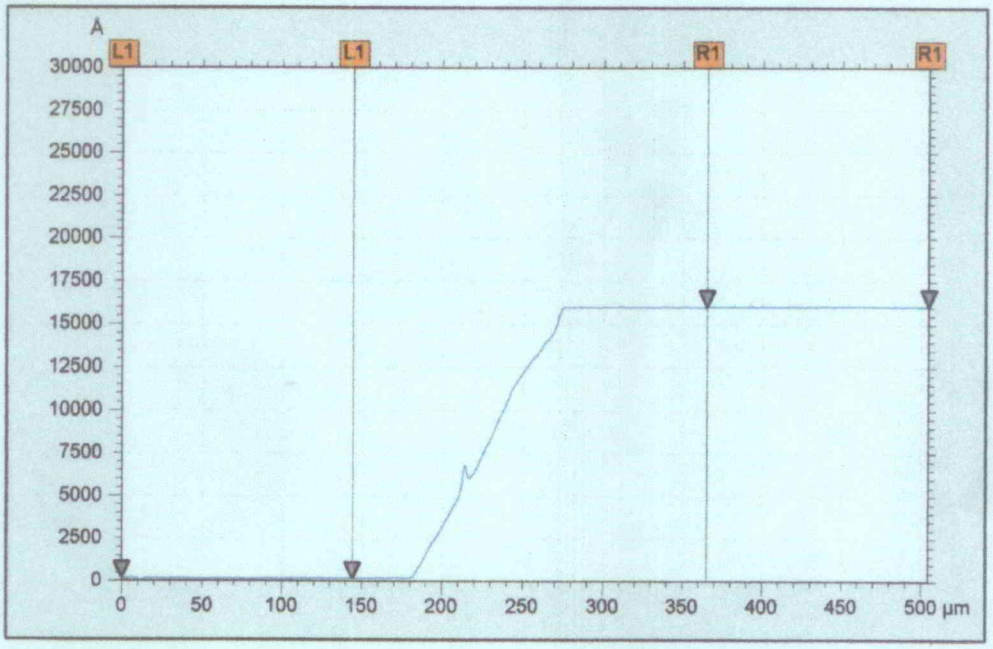
KLA Tencor **Alpha-Step IQ**

Document name: L2LDA1510161C-1

☑	Levelled (2 bars)
☐	Form removing: Deactivated
☐	Zooming: Deactivated

	Set1
StpHt	15906 Å

Parameter	Automatic	2 zones



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 ($1x10^{18}$)	μm (cm^{-3})	±10% (±20%)	C-V Test	On test wafer
2	N-$In_{0.52}Al_{0.48}As$ (λg=829.2nm) (Concentration)	0.05 ($2\sim0.8x10^{18}$)	μm (cm^{-3})	±10% (---)	---	---
3	N-GRIN-InAlGaAs (Al=0.38 to 0.35, λg=960.4 to 1000nm) (Concentration)	0.05 ($0.5\sim1x10^{18}$)	μm (cm^{-3})	±10% (---)	---	---
4	MQW (λ_{PL})	13.5 (1284)	nm (nm)	±5% (±7.5)	DCXD&PL measurement	On epi-wafer On test wafer
5	U-GRIN-InAlGaAs (Al=0.35 to 0.38, λg=1000 to 960.4nm)	0.05	μm	±10%	---	---
6	U-$In_{0.52}Al_{0.48}As$ (λg=829.2nm)	0.05	μm	±10%	---	---
7	P-InP (Concentration)	0.1 ($5x10^{17}$)	μm (cm^{-3})	±5% (±20%)	---	---
8	P-1.15μm InGaAsP (Concentration)	0.015 ($1x10^{18}$)	μm (cm^{-3})	±5% (±20%)	---	---
9	P-InP Cladding Layer, (Concentration)	1.6 ($1\sim2x10^{18}$)	μm (cm^{-3})	±10% (---)	C-V Test	On test wafer
10	P-1.3μm PQ Layer, (Concentration)	0.025 ($>3x10^{18}$)	μm (cm^{-3})	±10% (---)	---	---
11	P-1.52μm PQ Layer, (Concentration)	0.025 ($>3x10^{18}$)	μm (cm^{-3})	±10% (---)	---	---
12	P-InGaAs Layer, (Concentration)	0.2 ($>1x10^{19}$)	μm (cm^{-3})	±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：
(R&D Manager)

8.主管：林蔚
(Supervisor)

9.需求者/客戶簽認：
(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