Datasheet

Fourier Transform (FT) Photoluminescence (PL) Spectroscopy

ATP8900FTPL

Features:

- Higher sensitivity to weak signal in the infrared range
- Fast scan speed < 1second
- Non-expert operation
- Broad range of 4000-12500cm-1 (800-2500nm)
- Higher spectral accuracy thanks to continous modulation of pumped laser power
- Sample temperature from room temperature up to 77K.
- Multi-channel, high throughput, low noise and higher SNR

Application:

- Advanced optoelectronic material research
- Rare earth photoluminescence material performance check
- Semiconductor wafer quality inspection
- Infrared optoelectronic device quality control

Description:

Photoluminescence(PL) spectroscopy is effective tool of Non Destructive Testing, widely applied to semiconductor analysis such as the measurement of the band gap, inpurity defects, conpound semiconductor, and quality validation. In the infrared photoluminence range with disadvantage of weak signal, even experienced operator takes tedious time and energy to commissioning can result in weak PL spectral signal.

Compared with traditional dispersive spectrometer, Fourier transform FT spectroscopy based on mature theory and instrumentation, result in many advantages such as multi-channels, throughput, low noise, fast scan, and with sensitivity and SNR is significant higher.

Based on 20 years experience in researching weak signal and PL spectroscopy, launch this fourier transfrom infrared photoluminescence spectrometer.

ATP8900PL features excellent sensitivity in the infrared range, super fast scan speed, easy-to-operate for expert and non-expert. It covers the range of 4000-12500cm-1 (800-2500nm), wtih a continous modulation of pumped laser power, and sample temperature from room temperature up to 77K.

Product data information is current as of publication data.
Products conform to specifications per the terms of Optosky Standard warranty.

Floor 15th, Bld. A04, 3rd Software Park, Jimei, Xiamen, 361005, China
Tel: +86-592-6102588

Parameters	
Principle	Fourier Transform Dispersive Beam
Spectral range	4000-12500 cm-1
Spectral resolution	<2cm-1
Wavelength accuracy	<0.5cm-1
SNR	>500
Scan speed	<1 second per spectrum
Standard wavelength	532 nm
Power	5-100 mW
Stability	<1%
Other wavelength	671nm
Power	5-50 mW
Stability	<1% (rms@4hours)
Standard Croygenics	
Temperature	<85K
Obtained time	>4hrs
Coolhead dimension	diameter<30mm
Optional Croygenics	OptistatDN(Oxford)

Order guide:

Model	Description
ATP8900-FTPL	Single excitation laser with LND cryogenics
ATP8900-FTPL-Pro	Double excitation laser with laser power meter and LND cryogenics

Accessories

Model	Description
ATP8900-FTPL-LND	LND cryogenics, hold time for 4-8 hours
ATP8900-FTPL-OptistatDN	LND Temperature hold changeable Short sample change time Long cryogen hold time, around 15 hours

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Example Sample A

The InGaAs/GaAs/InAIAs quantum-dots sample was grown by molecular beam epitaxy(MBE) technique.

Test condition

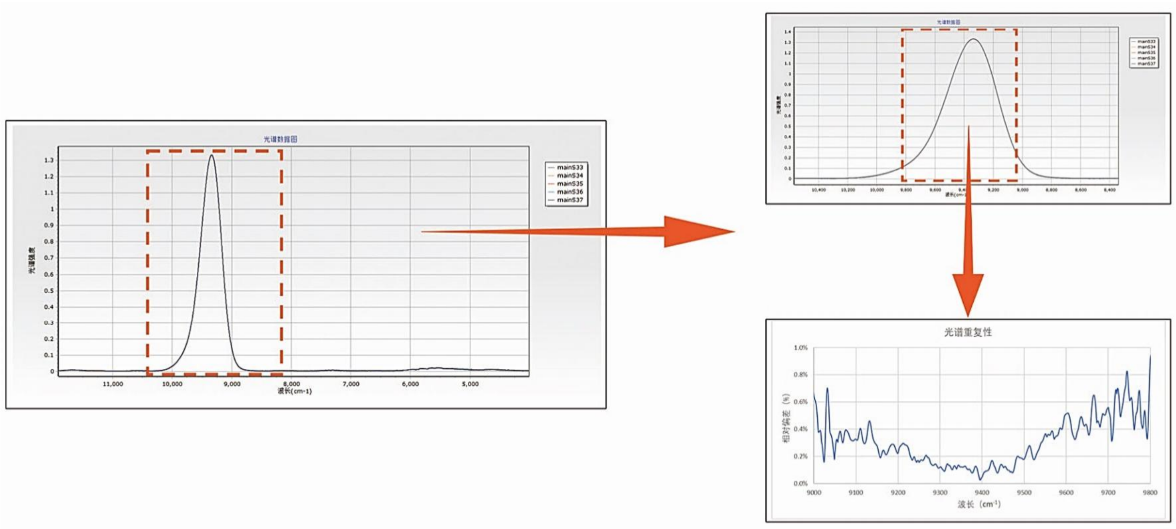
Sample temperature	77K
Pumped laser	532nm
Laser power	50mW

Instrument setting

Spectral resolution	8cm-1
Spectral range	4000-12500cm-1
Scan setting	repeat acquire 16 times get avarage, repeat 5 cycles at an interval of 2sec

Test Result

Single scan 14 sec, 5 cycles test result relative deviation <1% in the range of 9000-9800cm-1, spectrum shift<±0.4cm-1, SNR>1600 around 9300-9400cm-1



Test condition

Sample temperature	Liquid Nitrogen in cryogenics consume out, temperature rise from 77K up to 293K
Pumped laser	532nm
Laser power	50mW

Instrument setting

Spectral resolution	8cm-1
Spectral range	4000-12000cm-1
Scan setting	repeat acquire 16 times get average, repeat auto scan time of 2 hours and 20 seconds at a 5sec interval

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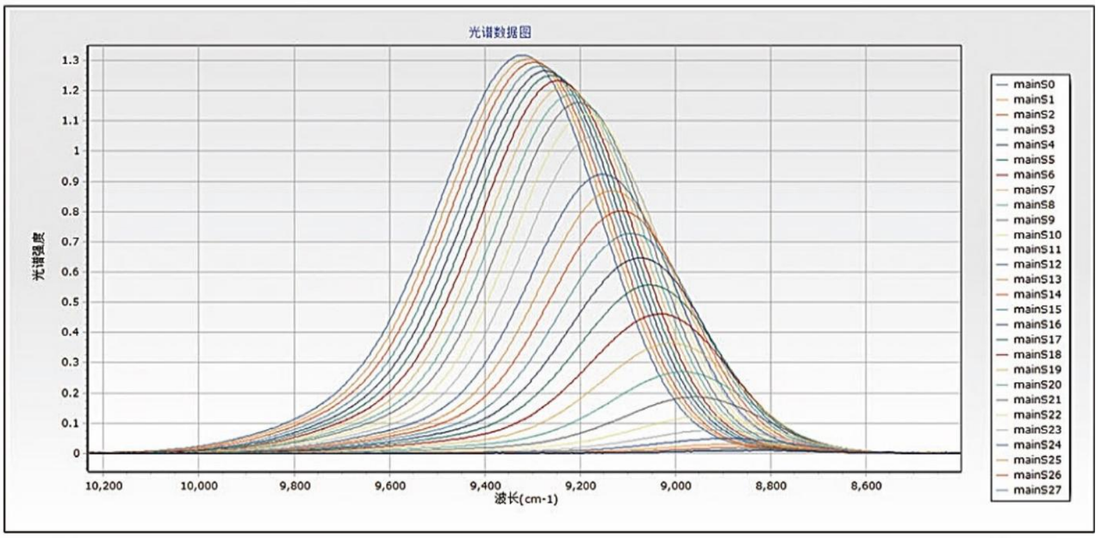
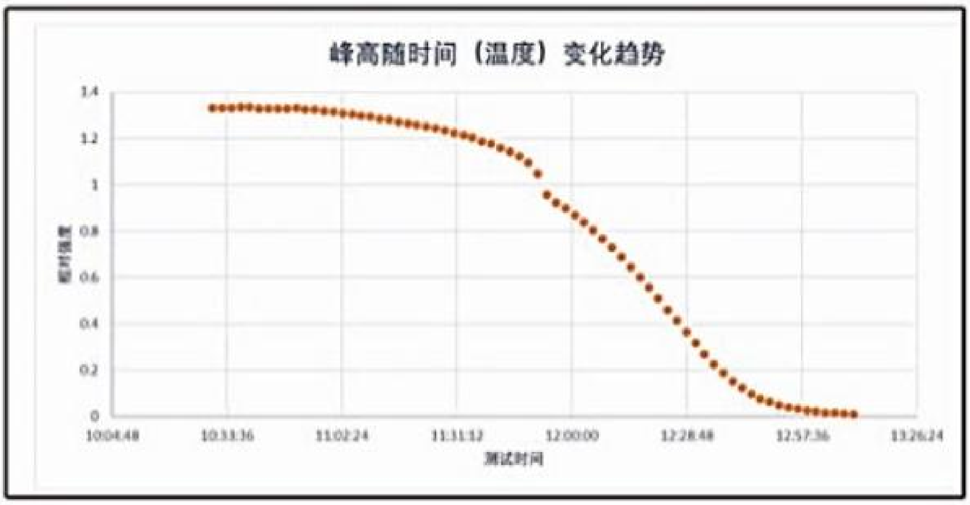
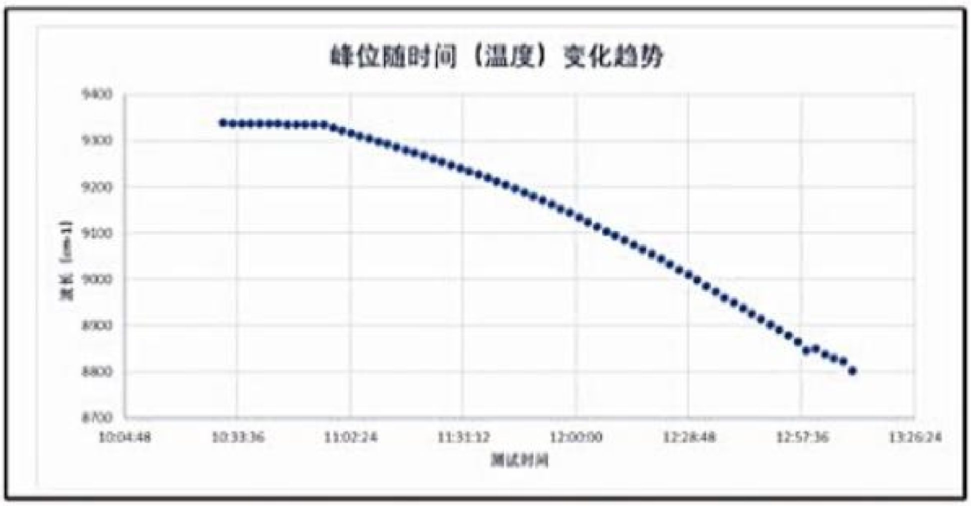
Test Result

It's observed temperature rise with time, PL spectrum shift from 9338cm-1 to 8803cm-1, PL height reduced from 1.33 down to 0.o111, this changing rule reflects long time stability at one side.







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Example Sample B

The InGaAs/GaAs/InAIAs quantum-dots sample was grown by molecular beam epitaxy(MBE) techni

Test condition

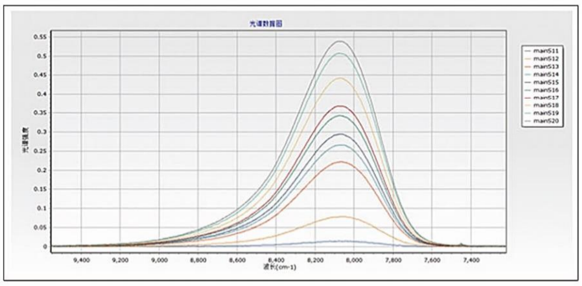
Sample temperature	Room temperature
Pumped laser	532nm
Laser power	10-210mW modulate rise from 10 to 210mW at a interval of 20mW

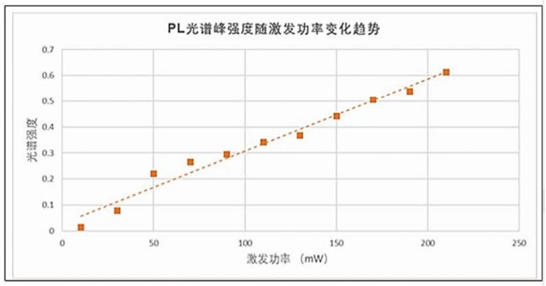
Instrument setting

Spectral resolution	8cm-1
Spectral range	4000-12500cm-1
Scan setting	repeat acquire 16 times get avarage

Test Result

Rise with pumped laser power, PL peak height increase with laser power in linearity, PL peak position in a tiny shift, It did not done any temperature control, pumped laser power could increase sample temperature rise a bit result in peak redshift.





Example Sample C

The GaSb single-crystal sample was grown by liquid encapsulated Czochralski(LEC) method using

high-purity(99.9999%) Ga and Sb metals as the raw materials.

Articles cite GaSb materials band gap change with the temperature.

Varshni 经验公式

$$E_0(T) = E_0(0) - \frac{\alpha T^2}{\beta + T}$$

Bose-Einstein 经验公式

$$E_0(T) = E_0(0) - \frac{2a_B}{\exp\left(\frac{\Theta_B}{T}\right) - 1}$$

Table1. Varshni and Bose-Einstein parameters extracted from fitting of the E_0 transition

Sample	$E_0(0)$ (eV)	α (10^{-4}eV/K)	β (K)	$E_0(0)$ (eV)	a_B (meV)	Θ_B (K)
GaSb	0.813	3.78	94	0.811	22	127

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Test condition

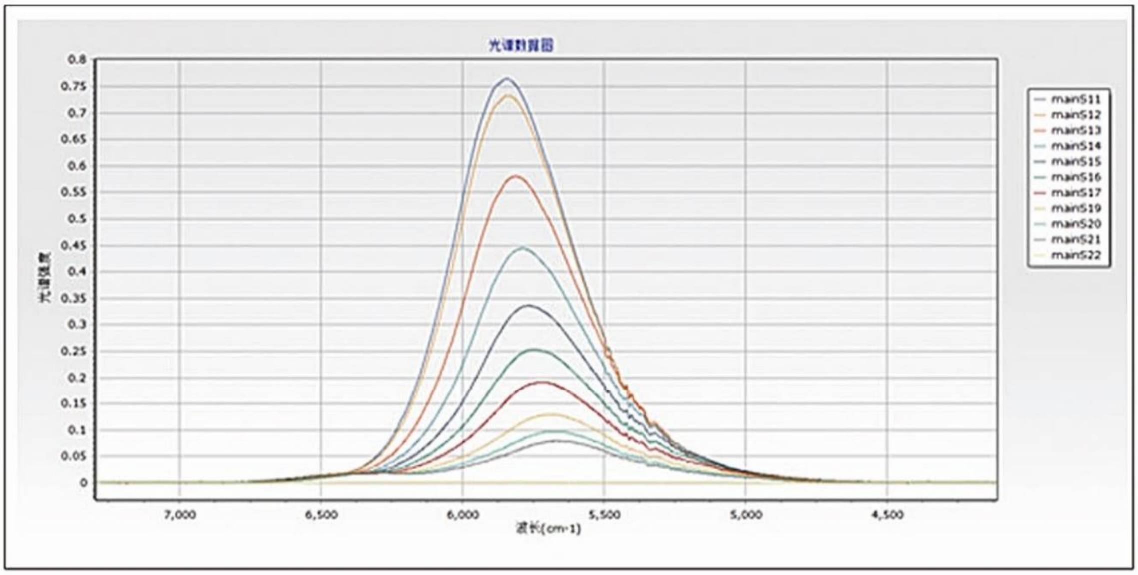
Sample temperature	Liquid Nitrogen in cryogenics consume out, temperature rise from 77K up to 293K
Pumped laser	532nm
Laser power	75mW

Instrument setting

Spectral resolution	8cm-1
Spectral range	4000-12500cm-1
Scan setting	repeat acquire 16 times get average at a 2sec interval

Test Result

PL peak position in a obvious redshift with the rising sample temperature, main peak height reduced, meanwhile, in around 6400cm-1 sub-peak is obvious caused by PL at the band tail, and energy band gap unchanged with the temperature.



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