HORIBA Scientific

HORIBA Jobin Yvon

Thin Film Division

Jean-Paul GASTON

UVISEL Plus

June 2017

HORIBA Scientific

UVISEL Plus

New generation of Uvisel including the up-to date electronics : The next generation of fastAcq technology

UVISEL Plus

- **The Most Accurate & Sensitive Ellipsometer on the Market :**
  - **Phase-modulated technology for pure and efficient polarization**
    - **Innovative technology without any mechanical movement**
  - **Double modulations for most accurate and faster measurements**
  - **High frequency modulation for better signal to noise ratio**
  - **Low stray light level - Double monochromator in FUV-Vis range**
  - **High resolution NIR monochromator**
  - **High performance Jobin Yvon gratings**
  - **Up-to-date electronics**

NEW!

Unique in The market

UVISEL Plus

- **The best lateral resolution**
  - **Confocal system**
  - **Achromatic micro-spot capabilities down to 50 µm**
- **Flexible system**
  - **Horizontal configuration**
  - **NIR extension in option**
  - **Large range of goniometers**
  - **Large range of sample holders**
  - **Large variety of accessories**
  - **Ex-situ, In-situ and cost-effective configurations**

- **The only upgradeable system on the market**
  - **One hardware**

UVISEL Plus

HORIBA Scientific

Unique in The market

- **The best accurate Ellipsometer**
  - The only material for which the ellipsometric parameters are absolutely known is air: an ellipsometric measurement in the straight-through configuration should by definition return

$$\Psi = 45° \ \& \ \Delta = 0°$$

UVISEL Plus	0.6 eV – 1.5 eV (833 nm - 2100 nm)	1.5 eV – 5.3 eV (235 nm – 833 nm)	5.3 eV – 6.5 eV (190 nm – 235 nm)
Psi = 45°	+/- 0.07°	+/- 0.01°	+/- 0.02°
Delta = 0°	+/- 0.06°	+/- 0.01°	+/- 0.02°

Integration time: 4sec – spot size : 1 mm – 26 spectrums

UVISEL Plus Specifications

HORIBA Scientific

- **Spectral range :**
  - **190 – 920 nm**
  - **Option NIR extension up to 2100 nm**

NEW!

- **Detections :**
  - **Double FUV scanning monochromator**
    - **High sensitivity photomultiplier detectors**
    - **Fast acquisition time**
    - **HJY Gratings & Motorised slits**
  - **For NIR extension**
    - **High resolution scanning monochromator**
    - **InGaAs detector**
    - **Fast acquisition time**
    - **HJY Gratings &Motorized slits**

NEW!

UVISEL Plus Specifications

- **Different type of goniometers :**
  - **Compact goniometer**
    - **45° to 90° by step of 5°**
  - **Manualy adjustable goniometer**
    - **55° to 90° by step of 5°**
  - **Motorized adjustable goniometer**
    - **40° to 90° by step of 0,01°**

UVISEL Plus Specifications

- **Sample holders :**
  - **Fixed Sample holder**
    - **150 mm**
    - **Manually adjustable height : 20 mm**
    - **Tilt**

  - **Motorised XY stage option**
    - **200 mm or 300 mm**
    - **Manually adjustable height : 4 mm**
    - **(Motorised height adjustement in option)**

  - **Rotation stage option**
    - **150 mm**
    - **360° automated sample rotation**
    - **Resolution 0,005°**

UVISEL Plus Specifications

- **Microspots :**
  - **Spot size : 2mm@90°**
  - **Manual microspots Option**
    - **3 positions : 50µm – 100µm - 1 mm**
  - **Automatic Microspots option**
    - **4 positions : 0,08 - 0,12 - 0,25 - 1,2 mm**

- **Light source :**
  - **75 W Xenon lamp in standard**
    - **150 W Xenon lamp in option**

HORIBA
Scientific
UVISEL Plus Specifications

- **New FastAcq Electronics**
  - Up-to-date Electronics based on Chopper
- **Full Spectrum 0,6 - 6,5 eV in less than 3 mn**
  - 4mn30 with old electronics
    - (Step : 0.05 eV and integration time : 200 ms)
  - Competition is up to :
    - ~30-60 minutes (Scanning Monochromator based)
    - ~ 1-2 minutes(CCD based) for similar performances
- **Shortest calibration time**
  - Calibration time : ~57 min
    - 127 min with the UVISEL

Comparison UVISEL & UVISEL+

Hardware	UVISEL	UVISEL Plus	UVISEL Plus Benefit
Modulation technology	Photo-elastic modulated	Photo-elastic modulated	Frequency 50kHz Best S/N
Acquisition based	Shutter	chopper	Double modulations Better S/N
Electronics		New FastTechnology	Faster acq time Faster calibration process
Detection	Single Mono FUV	Double Mono FUV	Low stray light in FUV
Slits	Manual in VIS Motorized in NIR	Motorized	Selection of the resolution
Gonio & Stage Capabilities		Like UVISEL	No AOI limited in FUV @ +/-15°
MicroSpot Capabilities	50 µm-100µm-1mm@90°	Like UVISEL	

UVISEL & UVISEL+ Configuration

Hardware	UVISEL	UVISEL Plus	UVISEL Plus Benefit
UV-VIS spectral range	210-880 nm	190-920 nm (Only 1 light source 75W Xe)	Thank to new detection
	190-880 nm (150 W Xe light source)		Option 150w Xe light source
NIR Spectral range	250-2100 nm		Option NIR Up to 2100 nm
Extended Spectral range	190-2100 nm		FUV in Standard and NIR in Option

Sales introduction

- **Quotation template ready**
- **Price list to be shared**
- **Press release ready and published**
- **Brochure under finalization**
- **Worldwide emailing under finalization**
- **Video in preparation**

5 unique selling points

1. Accuracy

- Best results on Air transmission measurements.

2. µspot capabilities

- Smallest achromatic microspots on the market

3. Modularity

- Upgradeable system

4. Spectral range

- FUV in standard and NIR in option

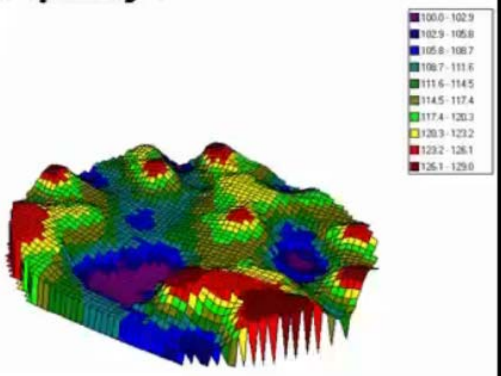
5. Spectral resolution

- Thickness range : 10 Å to > 50 µm

Sales Strategy

Microspot capabilities

- **Reduction of measurements errors**
  - **Polarisation is very sensitive to the surface quality :**
    - **Dust, Scratches, Contaminations, Patterns, shape**
- **Confocal backside rejection**
- **Higher resolution mapping**



One wavelength mapping (in case)

- **Faster than CCD and no Sensitive autofocus mandatory**
- **Time is less than 5 min for :**
  - **49 pts on 100 mm Si wafer**
  - **Integration time = 200ms**

Sales Strategy

Modularity

- **No easy upgrade with CCD based ellipsometers**
  - **Light source has to be changed**
  - **Spectrograph has to be added**
  - **Microspot not compatible with larger spectral ranges**

M2000 -Spectrocopic ellipsometer from Woollam

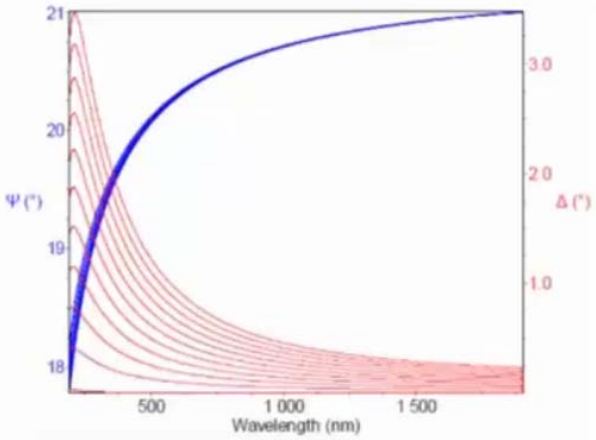
Model	Spectral range		Resolution	Bandwidth	Light source
Model V	370-1000nm	390 Wavelenghts	1,6 nm pixel	5 nm	6W Quartz tungsten Halogen (QTH)
Model VI	370-1690nm	590 Wavelenghts	3,4 nm pixel (NIR)	10 nm	6W Quartz tungsten Halogen (QTH)
Model U	245-1000 nm	470 Wavelenghts	1,6 nm pixel	5 nm	35W Deuterium+QTH
Model UI	245-1690 nm	670 wavelenghts	3,4 nm pixel (NIR)	10 nm	35W Deuterium+QTH
Model X-210	210-1000 nm	490 wavelenghts	1,6 nm pixel	5 nm	75W Xenon
Model XI-210	210-1690 nm	690 Wavelenghts	3,4 nm pixel (NIR)	10 nm	75W xenon
Model D	193-1000 nm	500 Wavelenghts	1,6 nm pixel	5 nm	35W Deuterium+QTH
Model DI	193-1690 nm	700 Wavelentghs	3,4 nm pixel (NIR)	10 nm	35W Deuterium+QTH

Sales Strategy

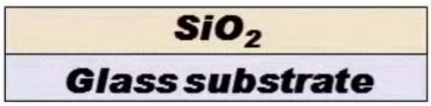
FUV in standard

- **The FUV range is where the technique is the most sensitive to measure thinner layers and interface**

	0Å	100Å	$\delta(\psi_{100Å} - \psi_{0Å})$ $\delta(\Delta_{100Å} - \Delta_{0Å})$
ψ@633nm	20.340	20.370	0.03
Δ@633nm	0.001	0.861	0.86
ψ@190nm	17.782	18.204	0.422
Δ@190nm	0.038	3.233	3.195



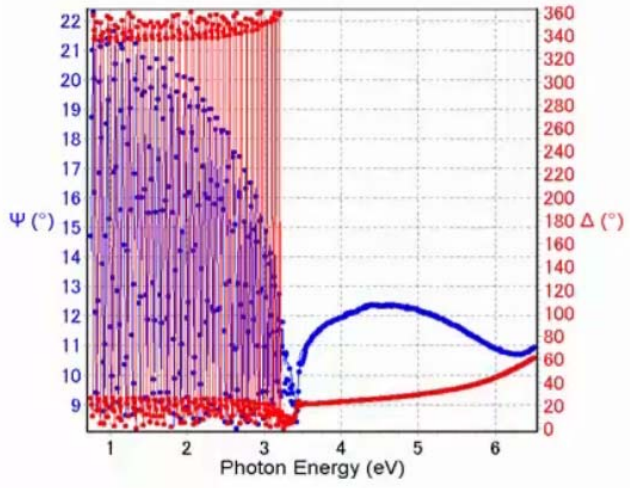
0 to 100Å

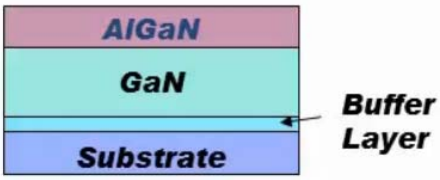


Sales Strategy

Spectral resolution

- **Thick layers involve :**
  - **Dense oscillations in NIR on the raw data**
  - **Absorption in visible (depending to the material)**
- **High resolution needed to model properly all oscillations**





Unique capabilities

- ***HJY ellipsometers are the most sensitive ellipsometers for ultimate materials science :***
  - To measure thinner layers (< 25 Å)
  - To measure thicker layers (> 12µm)
  - To detect Interface layers
  - To characterise films with low index contrast measurement
  - To measure sample with Glass substrate

UVISEL Plus Market

The REFERENCE ellipsometer for Ultimate MATERIAL SCIENCE

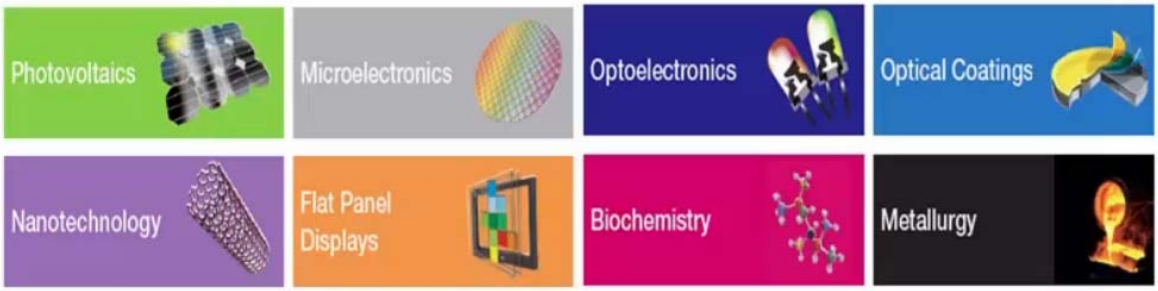
Wherever there are thin films !

Only one condition : Reflective sample

UVISEL Plus Market

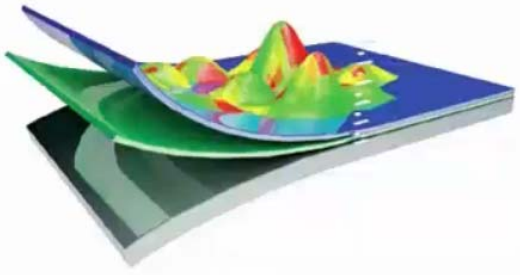
- **UVISEL Plus is ideal instrument to support :**

  - **Materials development**
  - **Materials Simulation**
  - **Optimizations of performance, Quality, Process controls**



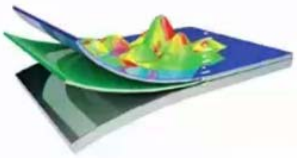
Customers Profile

- **Customer is dealing with Materials & Surface Treatments**
  - Their objectives :
    - Functional layers developments
    - Coatings optimizations
  - Their needs :
    - Materials development
    - Materials Simulation
    - Optimizations of performance
    - Quality & Process controls
  - Research and Industry

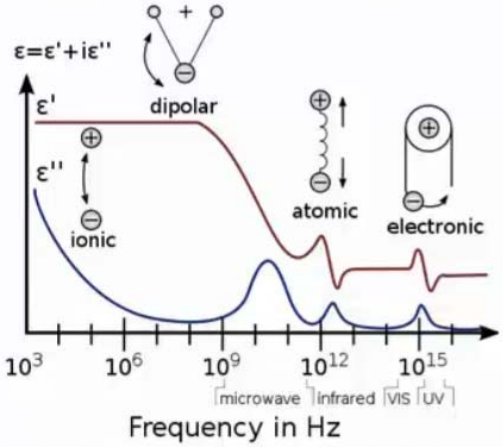


Customers

- **Customer needs to fully understand the material :**
  - Optical, Electronics, Mechanical properties



- **3 fundamental processes**
  - When an external electric field is applied onto isotropic material



⇐ ***Different resonances as function of frequency on the complex dielectrics constant :***
Fingerprint of the material

Only Ellipsometry provides the Electronic resonance in UV-VIS

Dielectric function describes material's response to electro-magnetic radiation

$$n - ik = \sqrt{\tilde{\varepsilon}} = \sqrt{\varepsilon_1 + i\varepsilon_2}$$

Conclusion

- ***UVISEL Plus***
  - ***The most sensitive and accurate spectroscopic ellipsometer on the market***
  - ***The reference ellipsometer***
    - ***5 unique selling points***

- *Real opportunity to do new researches in a growing ellipsometry field*