# Pioneer 180 Pulsed Electron Deposition System

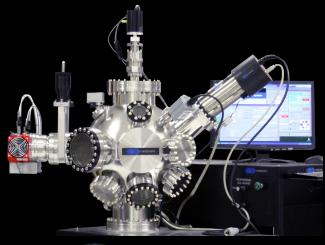


- Stand-alone turn-key Pulsed Electron Deposition (PED) System.
- Deposition of epitaxial films, multilayer heterostructures and Superlattices.
- Oxygen compatibility for oxide film depositions.
- Upgrades: Ion-assisted PED, Combinatorial PED, Substrate load-lock.
- Additional deposition sources: Pulsed Laser (for PLD) and RF/DC Sputtering.
- Integration with XPS /ARPES UHV Cluster tools, insitu UHV wafer transfer.
- Insitu diagnostics: Ion Energy Spectroscopy

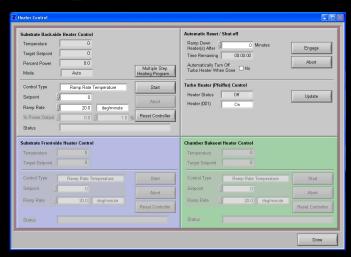


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#### Pioneer 180 Pulsed Electron Deposition System







#### **Deposition Chamber**

- 18" diameter spherical chamber
- 8" CF port with hinged door.
- 8" CF substrate heater port.
- 8" CF target carousel port.
- 6.75" CF PED source port.
- 6" CF RHEED gun port.
- 6" CF RHEED screen port.
- 6" CF pumping port.
- 3x 6" CF ports (RF, DC Sputtering and /or DC Ion guns/View ports).
- 6" CF Laser port (for PLD).
- Additional 2.75" and 1.33" CF ports.

# Programmable Radiative Substrate Heater

- Substrate temperature: 850°C (max).
- Substrate rotation:1-30 RPM (360° substrate rotation.
- Substrate size: 2-inch diameter (max), minimum dimension: 10 x10 mm<sup>2</sup>.
- Substrate sizes compatible with future load-lock upgrade.
- Heater temperature is controlled by a programmable PID controller
- Heater is oxygen compatible up to 1 atmosphere of Oxygen.
- Heater is top-mounted with substrate surface facing and parallel to ground.
- Pre-ablation shutter is included.
- K-type thermocouple provides input to the PID controller.
- The controller is integrated with Neocera System software (Labview 2013).











## Pioneer 180 Pulsed Electron Deposition System





- Target indexing, target rastering and target rotation are controlled by Lab-VIEW 2013 software, facilitating multilayers and superlattice depositions.
- Software controls external triggering of the PED source facilitating nanoscale thin film growth control.
- Software provides continuous composition spread of binary and ternary phase spreads (optional).

#### **Multi-target Carousel**

- Six 1-inch diameter targets or three 2-inch diameter targets.
- Target rotation, 360 degrees continuous (1-20 RPM).
- Target rastering (max 100 degrees/ sec) for uniform ablation over the entire target surface.
- Target indexing for multilayers.
- Target height is adjustable (manual adjustability for non-UHV Systems).
- Target shield protects targets from cross-contamination.
- Ideal for depositing epitaxial films, multilayers and superlattices.
- Unique target rastering protocol.
- Provides Continuous Composition Spreads/ Combinatorial PED capabilities.

arget Carousel & Rotation Motors Ta	arget Z Motor			
Control The Target Carousel Motor		Control The Target DC Rota	tion Mot	or
Motor Has Been Homed	Home	Motor is Enabled	-	Enable
Target or Angle Specific Angle (deg) 0.0	Move to Desired Target or Angle	Rotation Speed (deg/sec)	0.0	Rotate
Raster Type Specific Angle	Raster Motor	Actual Speed (deg/sec)	0.0	Stop Motor
Start Angle () 0.0 End Angle () 0.0				
Negative Raster 0.0		Control The Target AC Rota	tion Mot	or
Positive Raster () 0.0 Velocity (deg/sec) 10.0		Rotation Motor is Rotating	-	Start Rotation
Manual Rotation 0	Engage Pushbutton Control			Stop Rotation
Spin Speed (deg/sec) 0.0	Rotate at Constant Velocity	Target Carousel Positional Disable Positions	Offsets	Save Changes
Keep "Motor Has Been Homed" While Spinning at Constant Velocity No (Recommended)	Stop Motor	Use Position 1 0 60.0 Use Position 2 0 120.0	60.0	
Target Carousel Motor Feedback		Ose r usition 2 O gj 120.0	120.0	
Position (deg) 0.0  Velocity (deg/sec) 0.0		Target Size  1 Empty Empty Holder and Can Accept a Target		2 3
		Empty Holder and Cannot Accept a Target	1	4
Target Carousel Home Offset Home Offset	Save Carousel	1 Inch Target	(	6 5
Home Offset [] -2.5 -2.5 (deg)	Home Offset	2 Inch Target	<u> </u>	

# Pulsed Electron Deposition Source



- Energy of Electrons: 8-20 keV
- Maximum energy per pulse: 800 mJ
- Minimum energy per pulse: 100 mJ
- Process Gas Pressure: 3-20 mTorr.
- Process Gases: Oxygen, Nitrogen, Argon
- Pulse energy variations: +10%
- Pulse width: 100 ns
- Maximum Repetition Rate.: 10 Hz at 15kV, 5 Hz at 20kV
- Beam cross section, (min) :8 x10<sup>-2</sup> cm<sup>2</sup>
- Maximum power density: 1.3 x 10<sup>8</sup> W/cm<sup>2</sup>
- Z alignment range: 50 mm
- XY- alignment range: +/- 20 mm
- Cathode module lifetime  $\sim 3 \times 10^{-7}$  pulses

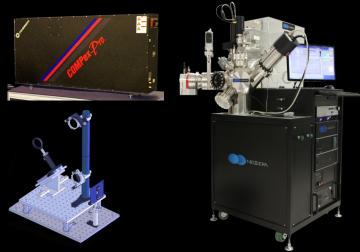
#### Vacuum Pumping Package

- All-dry vacuum pumps: Turbomolecular pump backed by dry mechanical pump.
- Minimum base pressure: 8 x 10<sup>-8</sup> Torr in standard systems.
- Turbo-speed is controlled by software.

#### **Pressure Measurement / Control**

- Wide range vacuum gauges for pressure measurement from atmosphere to 5 x 10<sup>-9</sup> Torr.
- MKS Mass Flow Controllers are integrated with PED System software. Flow rate~100 SCCM for Oxygen.
- Closed loop deposition-pressure control.

### PED and PLD in one System! Add a Pulsed Laser and Optics package.



### PED System Software

- Windows 7, LabVIEW 2013
- Controls substrate heating stage.
- Controls target carousel stage.
- Controls vacuum pumping stage.
- Controls Mass Flow Controllers.
- External triggering of PED source.
- Optional process automation.

For further information, please contact: sales@neocera.com or +1-301-210-1010, ext 104