Microwave Plasma CVD Systems for R&D and Production

CORNES Technologies Ltd.
Microwave plasma CVD systems

Seki Diamond Systems is the leading supplier of Microwave Plasma CVD Systems for Diamond research and production worldwide. Since acquiring ASteX’s technology in 1999, Seki has sold over 180 systems for advanced R&D and commercial production applications. Building upon ASteX’s excellent reputation in the scientific community, Seki has enhanced and expanded the original product line to provide a very wide range of standard and custom system and process solutions for Diamond and advanced carbon material synthesis.

Our highly reliable systems are the consistently #1 choice for R&D scientists wishing to shorten their process development time and leverage system compatibility with publications and diamond growth experts around the world. Seki’s systems are characterized by their unique process flexibility, repeatability and vacuum integrity to provide the highest quality diamond films and highest growth rates available for the most demanding R&D and diamond production applications.

1.5kW System Series

**AX5010-INT**
- Low cost manually controlled system with 1” deposition area
- Easy to use and small in size
- Quartz bell jar chamber
- Reactor Kit available (for user custom integration)
- Heater kit (optional with up to 850C max. temperature)
- Operating Pressure range: 10-50 Torr

**Applications**
- Microcrystalline
- Nanocrystalline
- Homoeptaxy
- Doped Films
- Hydrogenation

**AX5200M** (manual operation)
**AX5200S** (semi-auto operation)
**AX6300** (computerized recipe driven)
- Cold-wall, stainless steel reactor for excellent film quality
- Motorized, RF induction Heated Stage for high reliability in plasma environment
- Pressure Operation Range: 4-200 Torr
- Multi Diagnostic Ports & *In-situ* Monitoring
  - Nucleation and Film Thickness (by pyrometer)
  - Plasma Diagnostics (by emission spectroscopy)

**Applications**
- Conventional and Doped Micro-crystalline Diamond (2” diameter)
- Nano and Ultra Nano-crystalline Diamond (2-3” diameter)
- Carbon Nano-tubes (2-3” High Growth Rate and Device Quality)
- Single Crystal Diamond (High Growth Rate and Device Quality)
- Hetero-epitaxial Diamond (with DC biasing)
5.0kW System Series

**AX5250M** (manual operation)
**AX5250S** (semi-auto operation)
**AX6350** (computerized, recipe driven)
- Capable of Operating in High Power Density Plasma
- Equipped with Water Cooled Stage & Chamber
- Pressure Operation Range: 10-200 Torr
- Multiple viewports for *In-situ* process Monitoring
  - Nucleation and Film thickness (pyrometer)
  - Plasma Diagnostics (by optical mission spectroscopy)

**Applications**
- High Power Densities Plasmas (Accelerated Growth Rate)
- Optical Grade, Highest Quality Micro-crystalline Diamond (2” diameter)
- Various Thermal Grade, High Growth Rate Micro-crystalline Diamond (2” diameter)
- Single Crystal Diamond (High Growth Rate and Device Quality)

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**Model 6.0kW & 8.0kW** (for production and R&D)

**AX6500X / AX6500 Automated System**
- Computer Controlled Recipe Driven Operation
- Capable of Operating in Low to High Power Density Plasma
- Unique Capabilities of Temperature Control at High Power Densities
- Water Cooled Stage & Chamber
- Clamshell lid with Easy Access for substrate placement and chamber cleaning
- Pressure Operation Range: 10-200 Torr
- Multi Diagnostuc Oorta & *In-situ* Monitoring
  - Nucleation and Film thickness (by pyrometer)
  - Plasma Diagnostics (by optical emission spectroscopy)

**Applications**
- High Power Density Plasma (Accelerated Growth Rate)
- Optical Grade, Highest Quality Micro-crystalline Diamond (2-3” diameter)
- Various Grade, High Growth Rate Micro-crystalline Diamond (2-4” diameter)
- Single Crystal Diamond (High Growth Rate and Device Quality)
- Nano and Ultra Nano-crystalline Diamond (2-4” diameter)
Large Scale System for Production and R&D

**AX6600 75kW**

- Large Area Microwave Plasma Reactor (915MHz)
- Computer Controlled Recipe Driven Operation
- Capable of Low to High Power Density Plasma process
- Unique Capabilities for Temperature Control at High Power Densities
- Water Cooled Chamber & Stage
- Extremely Easy Access of Substrate and Inside Chamber
- Multi Diagnostic Ports & In-situ Monitoring
  - Nucleation and Film thickness (by pyrometer)
  - Plasma Diagnostics (by emission spectroscopy)

**Applications**
- Large Area High Power Density Plasma (Accelerated Growth Rate)
- Optical Grade, Highest Quality Micro-crystalline Diamond (6-8” diameter)
- High Growth Rate Micro-crystalline Diamond for thermal application Single Crystal using multiple batch seeds 6” diameter
- Nano and Ultra Nano-crystalline Diamond (8” diameter)

**Options**
- Optical Emission Spectrometer
- Additional Gas Channels
- Heater kit (for AX5010)
- Biasing Capability (for AX5200/6300)
- Temperature Measurement System (in-situ nucleation monitoring)
- Turbo Molecular Pump
- Dry Pump

### Specification of Different Models

<table>
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<tr>
<th>Source Model</th>
<th>AX5010</th>
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<tr>
<td>Integration Model</td>
<td>AX5010-INT</td>
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<td>50mm</td>
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<td>up to 7µm/hr</td>
<td>up to 15µm/hr</td>
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<td>90mg/hr</td>
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</table>
Examples of CVD diamond-coated wafers and tool inserts, as well as thick diamond films suitable for thermal management applications.

Raman Spectrum * of CVD diamond film

**Microwave Plasma**

A typical Ar-CH4 plasma

**Advanced Materials**

SEM Photograph showing aligned carbon nanotubes grown by microwave plasma CVD (AX5200S)

Single Crystal CVD Diamond (Courtesy of Dr. C. Yan, Carnegie Institution of Washington)

Examples of micro and nano-crystalline diamond films grown by a microwave plasma CVD system (Courtesy of T. Soga, Nagoya Institute of Technology)

* Spectrum taken with STR250 Raman Spectrometer manufactured by Cornes Technologies
Cornes Technologies is constantly seeking innovative products and advanced technologies to introduce to the Japanese market in response to the needs of business and industry.

With a network of international partners that extends across the globe, Cornes Technologies is able to bring to the attention of its customers the very best that the world has to offer.

In an era characterized by rapid change and advances in knowledge, Cornes Technologies prides itself on a proven ability to respond swiftly, flexibly and successfully to the diverse requirements and demands of the modern business world.

Cornes Technologies merged its wholly owned subsidiary, Seki Technotron Corporation as of April 1st, 2012. Under the umbrella of the Cornes Technologies organization, we also established Seki Diamond Systems as a new brand name for the manufacture and sale of Microwave CVD Diamond Systems.

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