ATC FLAGSHIP SERIES

Sputtering Systems

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GENERAL INFORMATION

AJA International **ATC Flagship Series Sputtering Systems** are versatile PVD coating tools which can be built in a variety of configurations to satisfy most requirements. These systems are built around AJA's unique A300-XP (UHV) or Stiletto Series (HV) magnetron sputtering sources, which feature in-situ source head tilting, allowing precise and repeatable con-focal, direct, and off-axis thin film deposition. All systems include a heavy duty hoist to lift the chamber top for system access.

Substrate holders with heating or cooling from 25mm to 300mm Ø are available on these machines. AJA magnetron sputter sources from 1"-12" Ø, plus rectangular, triangular, and turret sputter sources can be incorporated. The maximum number of sputter sources will depend on the substrate size, configuration, and magnetron sputter source size. For example, the ATC 1800 can be fitted with (5) 2" magnetrons with in-situ tilt. Consult the factory for optimum configuration. These versatile sputtering systems can be also fitted with other deposition sources and functionalities such as e-beam evaporation, thermal evaporation, PLD), ion milling, facing target sputtering sources (FTS), and contact masking systems. ATC Flagship Systems may also be equipped with metal-sealed tops, bake jackets, glove box integration, load-lock cassettes, auto-loading, and analytical tools (i.e. RHEED, XPS, Auger, RGA, Ellipsometry, and MOS).

LabVIEW based computer control and either turbomolecular or cryopumping are utilized depending on the application. ATC Flagship Systems can also be easily connected to each other or to ATC Orion Systems for multi-chamber (e.g. metal/oxide) or multi-technique (e.g. sputter/e-beam evaporation/thermal evaporation/PLD/ion milling/analytical) configurations.

SYSTEM FEATURES

- **Accommodates Con-Focal, Direct, and Off-Axis Sputter Source Configurations**
- **Sputter Up, Sputter Down, or Off-Axis Orientation**
- **Accommodates Substrates Ranging 1" to 12" Diameter**
- **Available Substrate Holder Capabilities: Heating (≤1000⁰ C), Cooling (LN2/H2O), Rotation, RF/DC Biasing, Z-Motion**
- **RF, DC, Pulsed DC, and HiPIMS Power Supplies Available**
- **Accommodates up to (4) MFC Gas Lines (Ar, O2, N2, H2 etc.)**
- **Semi Automatic or LabVIEW Based Computer Control System**
- **Turbopumped Load-Lock Systems Available**
- **HV or UHV Models Available (e-10-7 to e10-10 Torr)**
- **In-situ Analysis: RHEED, RGA, MOS, Ellipsometry, XPS, Auger, OES, etc.**

SUBSTRATE HOLDERS – HEATING / COOLING

The ATC Series Thin Film Deposition Systems are available with either motorized, rotating, substrate holders (for confocal configurations) or "T" arm substrate holders (for direct deposition). AJA's experienced design and manufacturing team also offers custom substrate holders to satisfy unique requirements. SHQ and SHQ-KC5 Series substrate heaters can achieve temperatures of up to 1000°C and can be fitted with reactive gas injection rings, substrate RF/DC bias capability for pre-cleaning and ion assisted deposition, in-situ manual or motorized Z motion for working distance adjustment and load-lock transfer, transverse magnetic field with in-situ orientation adjustment between layers and in-situ mask exchange (available with certain configurations). Indexing for "T" arms and for gradient depositions on rotating holders is accomplished with precise stepper motor systems. Electronic triggers for analytical applications are also available.

AJA manufactures its own PID based temperature controllers for rotation and Z motion. AJA SHQ Series substrate heaters utilize cost effective, durable, fast cycling, quartz halogen lamp technology while the highest temperatures are achieved with 5-lamp heaters.

Custom cooled substrate carriers (water/LN2/backside gas) are also available depending on the requirement.

MAGNETRON SPUTTERING SOURCE CONFIGURATIONS

AJA's exclusive Stiletto (HV) and A300 (UHV) Series Magnetron Sputtering Sources are designed for maximum application flexibility. These unique sources feature a modular magnet array which can be configured by the customer to operate in the nearly-balanced, unbalanced (Type II) and magnetic material modes. Gas injection chimneys and shutter systems are incorporated to facilitate in-situ tilting and prevent cross-contamination and target poisoning. 3" and 4" sources can be operated at pressures below 4 x 10-4Torr in combination with an ion source to perform IBAD at half the price and complexity of an ion beam assisted ion beam sputtering system.

(11) 2" UHV magnetron sputtering sources in confocal arrangement

(6) 3" UHV magnetron sputtering sources in confocal arrangement, (1) 3" sputter source in direct deposition orientation

(5) 4" UHV magnetron sputtering sources in confocal arrangement

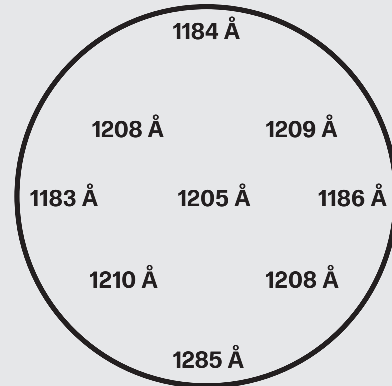
(8) 2" UHV magnetron sputtering sources in confocal geometry, (2) custom anti-shorting sputtering sources optimized for chalcogenide materials

Accommodates up to (13) sputtering sources with confocal, direct and off-axis orientation

(11) 2" UHV magnetron sputtering sources in direct deposition orientation with 4cm gridded DC ion source

TYPICAL RATE / UNIFORMITY DATA

The ATC Series Thin Film Deposition Systems can be configured for con-focal, direct, and off-axis deposition. Con-focal deposition with in-situ tilt sputter sources (AJA pioneered and developed this concept in 1991) can deliver uniformity of better than +/- 2% on substrates twice the diameter of the targets. Often +/- 1% or better is achievable. A typical deposition profile with SiO_2 on a 6" diameter Si wafer is shown.



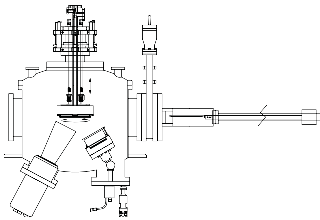
SiO_2 film thickness measurements over a 150 mm diameter Si wafer coated in a standard ATC 2200. This particular ATC 2200 was configured with (6) 3" A330-XP UHV magnetron sputter sources featuringin-situ tilt. This film was deposited by a single 3" source in a single run and achieves +/- 1.17% uniformity over 140mm diameter.

Deposition rate is a function of sputter yield of the material, maximum allowable power density into the target (depends on heat transfer capability of target material), and type of power used (e.g. RF, DC, pulsed DC).

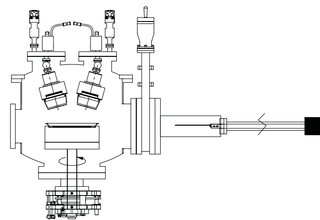
Maximum deposition rates are achieved with materials such as Au - high sputter yield, excellent heat transfer material and can be sputtered with DC (most efficient). Slow deposition rates can be expected with materials such as Al_2O_3 - very low sputter yield, poor heat transfer material and must be sputtered with RF (1/2 the efficiency of DC). Typical rates are 0-18 Å/sec with Au, 0-9 Å/sec with Cu and 0-0.16 Å/sec with Al_2O_3 in a confocal configuration with 2" sources on a 100 mm diameter substrate. Off-axis deposition rates are typically 1-5 times lower than con-focal deposition rates depending on substrate size and system configuration.

Direct deposition at short working distances (50-100 mm) can achieve rates as high as 300 Å/sec but con-focal geometry results in much better uniformity, the ability to co-deposit alloy films and the ability to grow better ultra-thin film multilayers since the substrate is always "in the plasma." The cost of the smaller targets employed in con-focal configurations can also significantly reduce operating cost. The ultimate system configuration offered will always depend on the application.

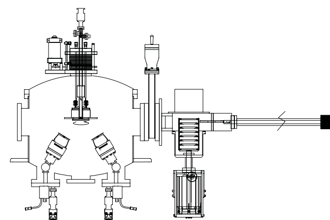
TYPICAL ATC FLAGSHIP SERIES SCHEMATICS



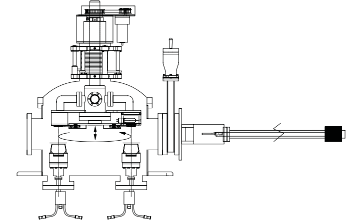
ATC 2200 IBAD with (3) A340-XP 4" UHV sputter sources with in-situ tilt, a RFICP plasma/ion source for ion beam assisted deposition below 5 x 10-4 Torr, 800° C rotating substrate heater with RF bias and motorized Z motion and a load-lock for 6" diameter substrates.



ATC 1800 Sputter Down with (3) ST-30 3" HV sputter sources with in-situ tilt, 800° C rotating substrate heater with RF bias, and a load-lock for 8" diameter transferable substrate trays.



ATC 2200 with (8) A320-XP 2" UHV sputter sources with in-situ tilt, 850° C rotating substrate heater with RF bias and motorized Z motion and cassette load-lock for (6) transferable 4" substrate carriers.



ATC 2000 with (6) A320-XP 2" UHV sputter sources, Heating/ Cooling inverted "T" arm, indexing substrate holder for 1.5" diameter samples (1000° C and LN2) with RF bias, and load-lock for 4" substrates.

For questions, quotes and ordering information please contact us directly:

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