



# ATC ORION SPUTTERING SYSTEMS

AJA INTERNATIONAL, INC.

## GENERAL INFORMATION

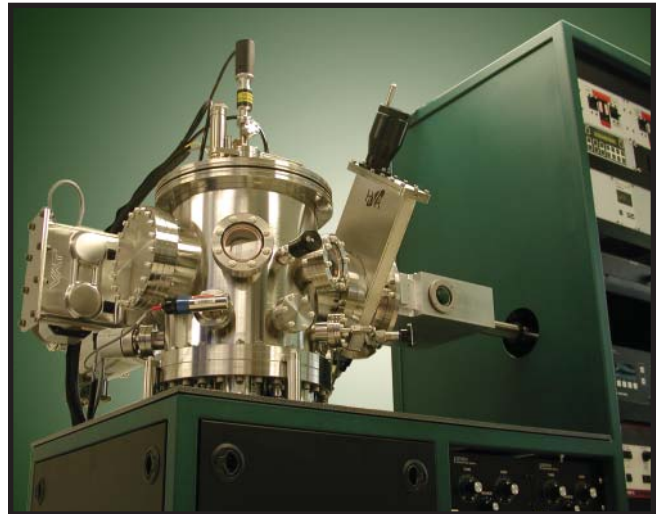
The AJA International, Inc. ATC ORION Series Sputtering Systems are compact versions of the popular ATC Series designed to deliver maximum performance for limited budgets. These HV and UHV systems inherit many design features and common parts from the highly evolved ATC-V & ATC-F sputtering tools and offer some unique features such as TUNING CHIMNEYS (patent applied) designed to optimize deposition uniformity. The standard ATC ORION modules (chambers, frames, cluster flanges, etc.) are generally in stock at AJA reducing delivery time. These systems use AJA's exclusive Stiletto (HV) and A300-XP (UHV) magnetron sputtering sources (2" and 3") and can be fitted with heating and cooling stages to accommodate substrates up to 6" diameter. Substrate temperature ranges from LN2 to 1000°C available depending on size and configuration.

## TYPICAL SYSTEM CONFIGURATIONS



### ATC ORION 3 UHV

1 TO 3 UHV MAGNETRON SPUTTERING SOURCES



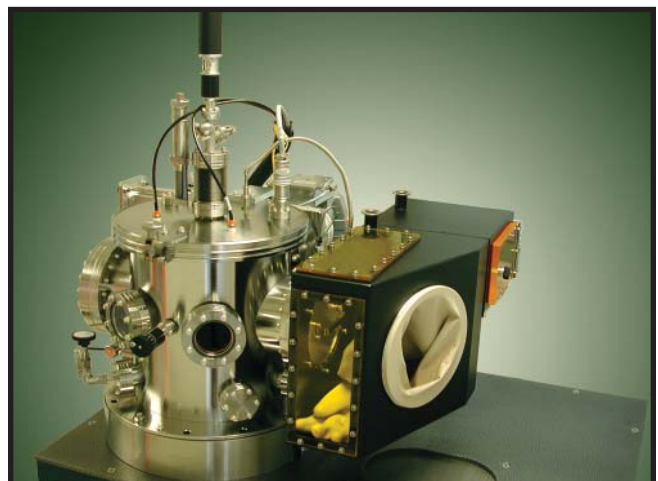
### ATC ORION 5 UHV

1 TO 5 UHV MAGNETRON SPUTTERING SOURCES



### ATC ORION 4 HV

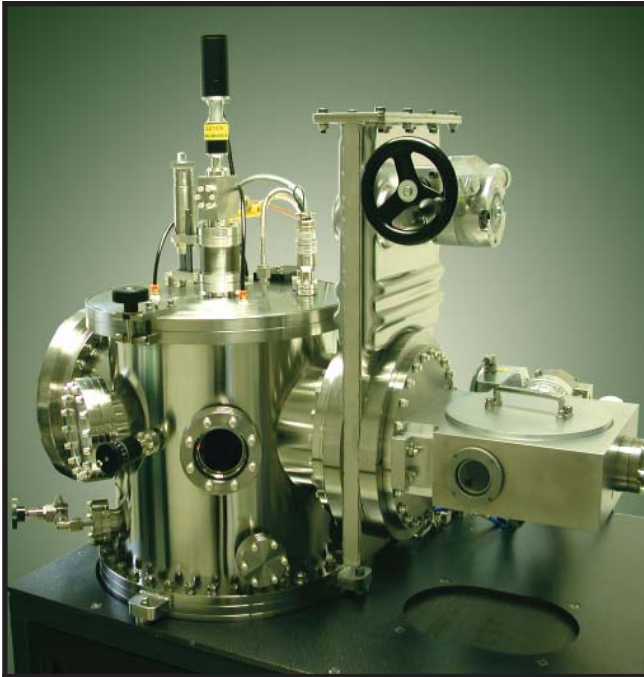
1 TO 4 HV MAGNETRON SPUTTERING SOURCES  
SHOWN HERE WITH TURBO PUMP VACUUM LOAD LOCK



### ATC ORION 5 HV

1 TO 5 HV MAGNETRON SPUTTERING SOURCES  
SHOWN HERE WITH NITROGEN GLOVE BOX

## TYPICAL SYSTEM CONFIGURATIONS



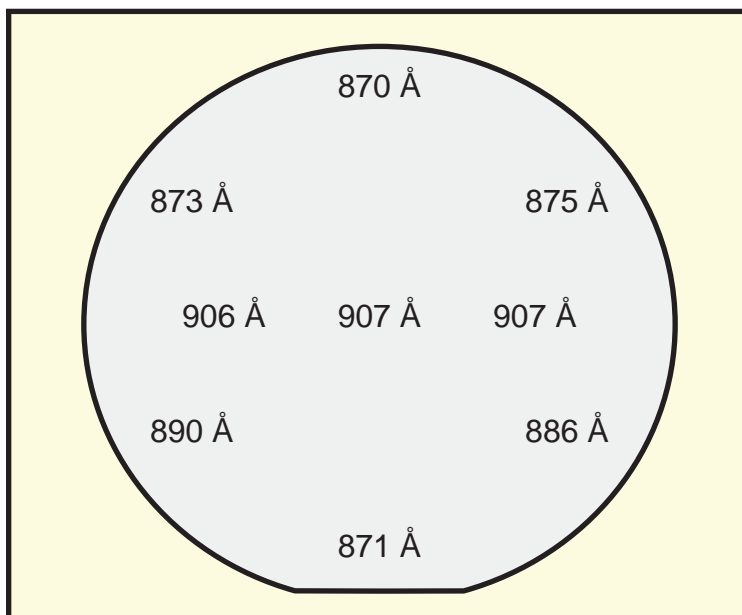
**ATC ORION 8 UHV**  
 FITS UP TO (8) 2" UHV MAGNETRON SPUTTERING  
 SOURCES - SHOWN W/ VACUUM LOAD LOCK



**ATC ORION 8 HV**  
 FITS UP TO (4) 3" HV MAGNETRON  
 SPUTTERING SOURCES

## TYPICAL RATE / UNIFORMITY DATA

The ATC ORION Series Sputtering Systems feature a con-focal sputter source flange oriented at specific angles determined from many years of experience with the in-situ tilt sources found on the ATC-V and ATC-F systems. The specially designed chimney / ground shield / shutter system allows a high degree of deposition uniformity over substrates more than twice the target diameter. A typical deposition profile with SiO<sub>2</sub> on a 4" diameter Si wafer is shown below.



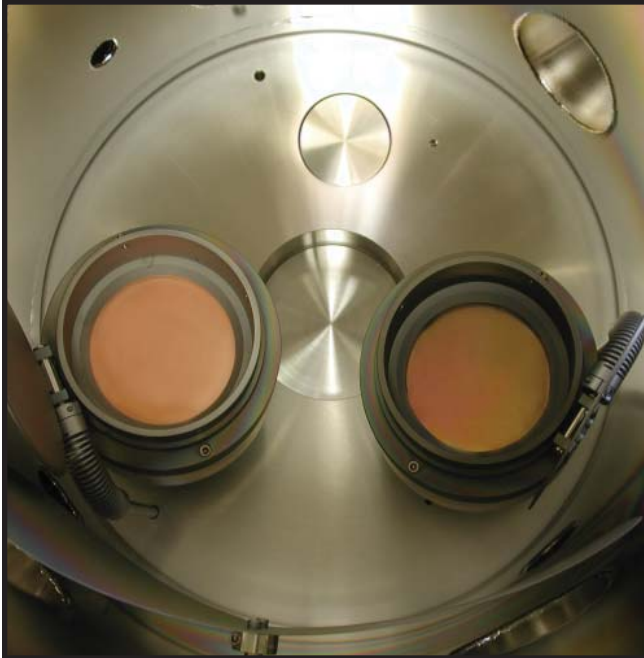
Deposition rate is a function of sputter yield of the material, maximum allowable power density into the target (depends on heat transfer capability of target material), and type of power used (eg. RF, DC, pulsed DC). Maximum deposition rates are achieved with materials such as Au - high sputter yield, excellent heat transfer material and can be sputtered with DC (most efficient). Slow deposition rates can be expected with materials such as Al<sub>2</sub>O<sub>3</sub> - 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<sub>2</sub>O<sub>3</sub>.

Direct deposition at short working distances can achieve higher rates but con-focal geometry results in 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."

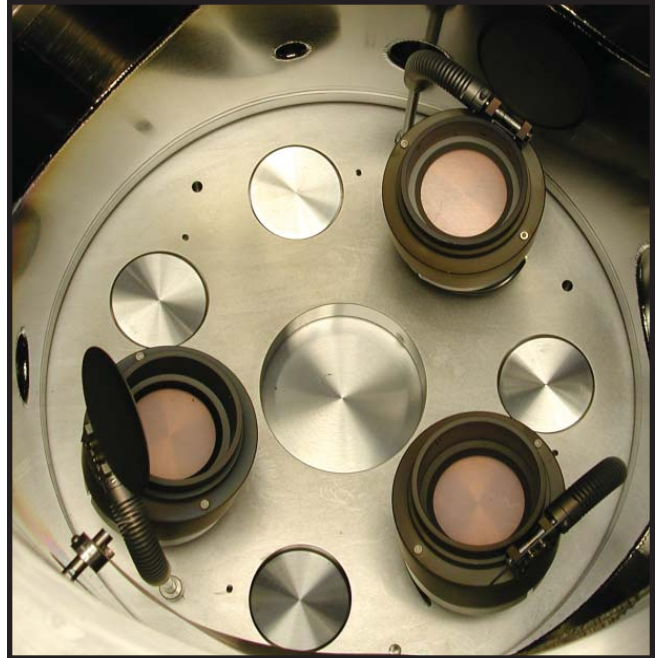
ABOVE LEFT: Deposition of SiO<sub>2</sub> on 100mm diameter Si wafer at 150 Watts, 3mTorr, 5.5" working distance. Uniformity is ± 2.08%

## **SPUTTER SOURCES / CLUSTER FLANGES**

AJA's Stiletto-O (HV) and A300-XP-O (UHV) magnetron sputtering sources (2" & 3" target sizes) are designed specifically to fit cluster flanges for the compact ATC ORION Systems. They feature tunable isolation chimneys with gas injection and flip-top shutters to accommodate compact spaces and custom chimney designs. The basic magnetron/cathode assembly is identical to the unique AJA A300 Series modular magnetrons which are used in the ATC-V and ATC-F systems. The magnet array can be configured by the customer to operate in the balanced, unbalanced (Type II) and magnetic material modes. Due to the compact design, the complete shutter, isolation chimney and ground shield assembly is quickly removed with only two screws for easy target access.



**ATC ORION 8 CLUSTER FLANGE  
ACCEPTS (3) OR (4) 3" SOURCES**



**ATC ORION 8 CLUSTER FLANGE  
ACCEPTS UP TO (8) 2" SOURCES**



**ATC ORION 4 HV  
SPUTTER DOWN CLUSTER FLANGE**



**ATC ORION 3 UHV  
SPUTTER UP CLUSTER FLANGE**

## SUBSTRATE HOLDERS / HEATERS



The con-focal ATC ORION systems utilize motorized, rotating substrate holders to achieve excellent uniformity, allow the co-deposition of alloy films and facilitate the deposition of pristine ultra-thin film multilayers since the substrate is always "in the plasma". These substrate holders can be heated up to 850 °C (special heaters to 1000 °C are available for small substrates) and feature reactive gas injection rings, substrate RF and DC bias capability, in-situ manual or motorized Z motion (for working distance adjustment and load-lock transfer) and in-situ mask exchange (available only with certain configurations). Custom cooled substrate carriers (air / water / LN 2 / LHe) are also available depending on the application requirement.

## PHASE II-J COMPUTER CONTROL



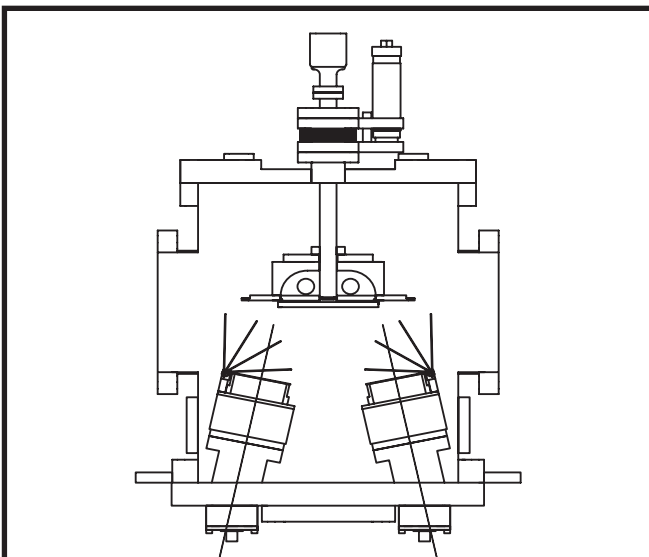
AJA International's Labview based Phase II-J computer control system is used on all ATC systems including the ATC ORION versions. This straightforward, user friendly control system utilizes a large, flat-screen laptop in a 19" rack drawer connected to a single 7" high x 19" wide rack mount hardware module. The back panel of the hardware module is populated with connectors to interface to all aspects of the sputtering system.

The Phase II-J control system allows the user to operate in either the "manual mode" or the "automated processing mode". In the "automated processing mode" the user designs process "layers" which are then compiled and saved as a "process". The system allows 10 unique user entry points which are accessible only by password, limiting access to a user's layers and preventing unexpected corruption of a user's saved processes.

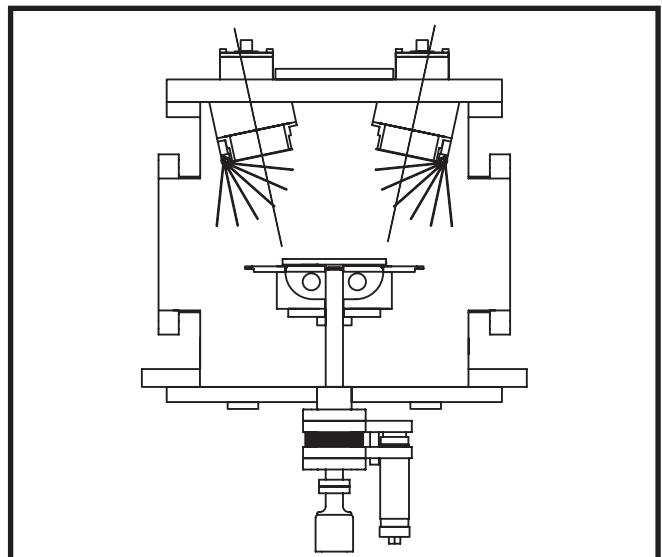


The standard Phase II-J control system will accommodate up to (5) DC power supplies, (4) RF power supplies, (1) 4-way DC switchbox, (1) 3-way RF switchbox, (4) process gases, closed loop automatic pressure control and substrate temperature control. Processes are aborted if plasma is not detected. Special "soak layers" can be easily incorporated into the process. Finally, data logging is standard with an adjustable refresh period. Process data can be downloaded to common spreadsheet programs.

## TYPICAL ATC ORION SYSTEM SCHEMATICS



ATC ORION 5 UHV SPUTTER UP



ATC ORION 5 HV SPUTTER DOWN

# SYSTEM OPTIONS



SUBSTRATE HEATERS



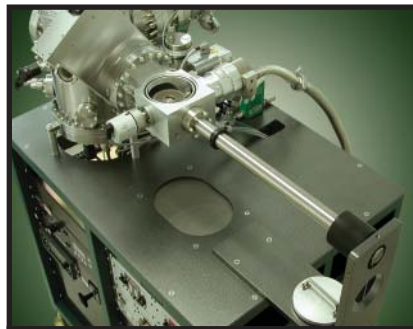
SPUTTER DOWN CLUSTER FLANGES



SPUTTER UP CLUSTER FLANGES



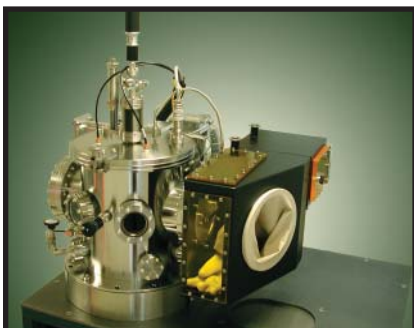
VACUUM PUMPING



TURBO-PUMPED LOAD LOCK



POWER DISTRIBUTION MODULES



NITROGEN GLOVE BOX LOAD LOCK



MFC GAS HANDLING



COMPUTER CONTROL



RF & DC POWER SUPPLIES



SPUTTERING TARGETS



AUTOMATIC PRESSURE CONTROL