

TECHNICAL SPECIFICATIONS

**FOR THE SUPPLY OF
AN 'EB-GUN EVAPORATOR'
FOR
SCUOLA SUPERIORE SANT'ANNA**

**ALLEGATO "A" – LOTTO 2
PROCEDURA APERTA IN LOTTI PER LA FORNITURA DI
APPARECCHIATURE SCIENTIFICHE PER IL PROGETTO PIC**

CUP: J55E12000200003

CIG: 521824472B



Index

INTRODUCTION	3
1. TECHNICAL SPECIFICATIONS: MINIMUM REQUIREMENTS	3
1.1 HARDWARE CONFIGURATION.....	3
1.2 PROCESS CONFIGURATION	4
1.3 CONDITIONS.....	4
2. TECHNICAL SPECIFICATIONS: EVALUABLE FEATURES	4
2.1 HARDWARE CONFIGURATION.....	4
2.2 PROCESS CONFIGURATION	5
2.3 CONDITIONS.....	5
3. INSTALLATION, ACCEPTANCE, DOCUMENTS, TRAINING	5
3.1 INSTALLATION	5
3.2 ACCEPTANCE	5
3.3 DOCUMENTS	5
4. APPENDIX.....	6
4.1 SUMMARY TABLE OF MINIMUM REQUIREMENTS.....	6
4.2 SUMMARY TABLE OF EVALUABLE FEATURES	7

INTRODUCTION

This technical specifications summarize the main requirements for an EB-gun evaporator to process controlled depositions of thin film multilayer. The equipment will be installed inside the Clean Room of TeciP Institute. Common depositions on Silicon wafers will include materials which Titanium, Titanium nitride, Chromium, Nickel, Aluminum, Platinum, Gold, Gold/Tin alloys. Most layers will be then defined by liftoff processes.

1. Technical specifications: minimum requirements

1.1 Hardware configuration

- ❖ Clean Room compatibility: class 1000
- ❖ Set up for "through the wall" installation
- ❖ Designed for depositing films to obtain a successful layer definition by liftoff process
Angle of incidence to the substrate the closest to 90°
Distance from source to substrate greater than 1mt
- ❖ Substrate holder for lift-off application
Set up for loading at least six 6" Si wafer
Capable of easy and quick switch for loading at least six 8" Si wafers
- ❖ Complete set of protection shields for chamber and base plates. An additional spare set for cleaning cycle.
- ❖ Source holder and power supply set up:
 - constant voltage power supply > 10kw
 - fully digital beam sweeping
 - pocket driven holder hosting 4 or 6 pockets, to be defined according to application table:

Film	Thickness [Å]	Rate [Å/sec]	Note
Ti	500	>5	
TiN	800	>5	N2 partial pressure
Cr	700	>5	
Ni	3000	>5	
Al	8000	>5	
Pt	2500	>5	
Au	2500	>5	
Au	3-6um	> 10	for 80Au/20Sn
Sn	3-6um	> 10	

- ❖ Deposition rate controller:-automatic control of dep rate and film thickness
 - at least 2 quartz crystals with shutter for selection
 - thickness resolution: 0.1 Å
 - rate resolution: 0.1 Å/sec
 - crystals health monitoring system
 - possibility of manual configuration of material density and acoustic impedance, and manual adjustment of tooling factor
- ❖ Substrate heating system up to 300°C
- ❖ Set up software/hardware for N2 reactive coatings (TiN deposition), including high vacuum throttle valve
Possibility of future upgrade for O2 partial pressure deposition

- ❖ System for soft venting
- ❖ Vacuum system characteristics:
 - Rough vacuum pumping system; High vacuum by cryopump system
 - High vacuum valve with throttle position
 - Base pressure: < 2.0E-7mbar
 - Rate of rise (from base pressure over one hour): <5.0E-5 mbar*/s
 - Pumpdown performance (at best conditions): 10min <6.0E-05 mbar
20min <2.0E-05 mbar
40min <2.0E-06 mbar

1.2 Process configuration

- ❖ The following film specifications has to be demonstrated on 6" wafer and uniformity masks must be provided:

Film	Wafer Temperature [°C]	Bulk resistivity [ohm*m]	Thickness [Å]	Rate [Å/sec]	Uniformity within Wafer	Uniformity Wafer to Wafer	Uniformity Run to Run
Ti	≤ 80	4.20E-7	1000	≥5	+/-3%	+/-3%	+/-3%
Pt	≤ 80	1.06E-7	2000	≥5	+/-3%	+/-3%	+/-3%
Au	≤ 80	2.44E-8	5000	≥5	+/-3%	+/-3%	+/-3%

- ❖ Edge exclusion: 2mm
- ❖ Rate: (average thickness of one wafer) / (deposition time)
- ❖ Uniformity defined as follow :
 - Within Wafer Uniformity is defined as:
(the high reading – the low reading) / (2*average of all readings)
 - Wafer to Wafer Uniformity is defined as:
(the highest average – the lowest average) / (2*average of all wafer averages)
 - Run to Run Uniformity is defined as:
(the average of the wafers from one run – the average of the wafers from a different run) / (2*the average of the wafers of both runs)
- ❖ A mechanical stylus profilometer and a four point prober are used to collect thickness and sheet resistance data for acceptance test at our site

1.3 Conditions

- ❖ Conformity to CE standard and certification
- ❖ Warranty 1 year
- ❖ Availability of spare parts guaranteed for minimum 10 years
- ❖ Shipment and installation included to:
Scuola Superiore Sant'Anna (TeciP Institute)
Via Giuseppe Moruzzi 1
56127 Pisa (Italy)

2. Technical specifications: evaluable features

2.1 Hardware configuration

- ❖ Remote software support with modem
- ❖ Upgradable to optical monitoring for direct substrate measurement
- ❖ System to reduce overheating of cryopump from process chamber outgassing
- ❖ Higher Wafer loading capability

- ❖ High vacuum throttle valve with position settable 0-100% (no fixed number of positions)
- ❖ Higher number of quartz crystals in chamber for material specialization
- ❖ Vacuum performance
- ❖ Full data logging capabilities
- ❖ Software support for uniformity improvement and design of uniformity masks

2.2 Process configuration

- ❖ Better Within Wafer film uniformity (less than +/-3%)
- ❖ Better Run to Run film uniformity (less than +/-3%)
- ❖ Lower substrates temperature achieved during film deposition (less than 80°C)

2.3 Conditions

- ❖ Consumable spare parts kit for yearly ordinary maintenance
- ❖ One extra year warranty

3. Installation, acceptance, documents, training

3.1 Installation

Scuola Superiore Sant'Anna, by following the supplier directions, is in charge for: moving the crate from the track to the site, opening the package, tool positioning in the working area, connecting all the necessary facilities to the tool.

Supplier must check for the correct placement and connection, facilities presence, flow and pressure value. Execute the acceptance procedure, final and functionality test.

3.2 Acceptance

Installation and commissioning, followed by process start-up with demonstration of defined process specification must be performed onsite by the Supplier.

3.3 Documents

Supplier must:

1. Detail configuration of the equipment and list of parts and components
2. Deliver layout of installation and the list of the facilities required for a proper functioning of the tool.
3. Deliver process data according to our specs ([paragraph 1.2](#)).
4. Deliver procedures for standard operations and maintenance.
5. Deliver safety instructions
6. CE conformity declaration
7. Describe after sales service and support solution.

The compliance of the equipment to the minimum requirements and to the evaluable features must be evident in the documentation (1-7).

4. Appendix

4.1 Summary table of minimum requirements

The compliance of the equipment to the minimum requirements must be evident in the documentation ([paragraph 3.3](#)).

Summary Minimum requirements			
Parameter	Target Specs	Units	Note
configured for 'through the wall' installation	yes		
designed for liftoff application	yes		
source to substrate distance	≥ 1	m	
# substrates loadable	≥ 6		6" wafers
upgradable for 8" wafers (liftoff configuration)	yes		≥ 6 loading capability
Complete set of protection shields (plus backup set)	yes		
constant voltage power supply	≥ 10	kw	
Fully digital beam sweeping	yes		
pocket driven holder	yes		tbd according to application table in paragraph 1.1
automatic control of dep rate and film thickness	0,1	Å	thickness resolution
	0,1	Å/sec	rate resolution
# of sensor heads	≥ 2		quartz crystal
crystal health monitoring system	yes		
substrate heating up to 300°C	yes		
set up for N2 reactive coatings deposition	yes		
high vacuum valve with throttle position	yes		
upgradable for O2 reactive coatings	Yes		
system for soft vent	yes		
vacuum characteristics	$\leq 2,0E-7$	mbar	base pressure
	$\leq 0,0E-5$	mbar*/l/s	rate of rise
	$\leq 2,0E-6$	mbar	40min pumpdown
process acceptance	yes		according to paragraph 1.2
conformity	CE mark		
Availability of spare parts	>10	years	
warranty	1	year	
shipment, installation, start up	included		

4.2 Summary table of evaluable features

The compliance of the equipment to the technical specification assessable as improvements must be evident in the documentation ([paragraph 3.3](#)).

4.2.1 Summary Evaluable Features (qualitative evaluation)			
Item	Parameter	Qualitative evaluation system	Max points
Configuration			
A.1	Vacuum performance	The improvements are lower base pressure, lower rate of rise, lower pumpdown timing, than minimum required; data must be evident and detailed in the documentation (paragraph 3.3)	6
Process			
B.1	Better Within Wafer film uniformity	Film uniformity improvements, for defined materials Ti, Pt, Au (see paragraph 1.2), are evaluated according to the documentation (paragraph 3.3 part3)	4
B.2	Better Run to Run film uniformity	Film uniformity improvements, for defined materials Ti, Pt, Au (see paragraph 1.2), are evaluated according to the documentation (paragraph 3.3 part3)	4
B.3	Lower substrate temperature rise during deposition	Substrate temperature achieved during process, for defined materials Ti, Pt, Au (see paragraph 1.2), is evaluated according to the documentation (paragraph 3.3 part3)	6
MAX TECHNICAL POINTS (qualitative part)			20

4.2.2 Summary Evaluable Features (quantitative evaluation)			
Item	Parameter	Quantitative evaluation system	Max points
Configuration			
A.2	Modem for remote software support	If the parameter is absent = 0 If the parameter is present = max points	2
A.3	Upgradable to optical monitoring	If the parameter is absent = 0 If the parameter is present = max points	3
A.4	System to reduce overheating of cryopump from process chamber outgassing	If the parameter is absent = 0 If the parameter is present = max points	3
A.5	Higher wafer loading capability	Minimum load is 6 wafers (150mm). Each additional wafer offered by supplier (a) is considered through the formula: $P(a) = \text{Offer}(a) / \text{Offer max} * \text{max points}$	15
A.6	High vacuum throttle valve with position settable 0-100% (no fixed number of positions)	If the parameter is absent = 0 If the parameter is present = max points	6
A.7	Higher number of quartz crystals	Minimum 2 crystals selection in chamber. Each additional one offered by supplier (a) is considered through the formula: $P(a) = \text{Offer}(a) / \text{Offer max} * \text{max points}$	15

A.8	Full data logging capabilities	If the parameter is absent = 0 If the parameter is present = max points	3
A.9	Software support for uniformity improvement and design of uniformity masks	If the parameter is absent = 0 If the parameter is present = max points	3
Condition			
C.1	Consumable spare parts kit for yearly ordinary maintenance	If the parameter is absent = 0 If the parameter is present = max points	5
C.2	One extra year warranty	If the parameter is absent = 0 If the parameter is present = max points	5
MAX TECHNICAL POINTS (quantitative part)			60