Special Plastic Module for semiconductor industry

S.P.M. s.r.l.

Prototypes

S.P.M. is an Italian company born in 1988.

Since its foundation, S.P.M. has distinguished in the realization of equipments dedicated to semiconductor companies.

S.P.M. every year invest in R&D, focusing on the realization of innovative prototypes. Thanks to research S.P.M. can propose to its customer different solution and solve problems finding new way of processing, cleaning, handling and chemicals management.

S.P.M. customer receives lot of advantages with prototypes, because they can see how the equipment works before buying it.

Here in this presentation you will find the list of last S.P.M. prototypes.

Last Prototypes

Icarus Model

Nautilus Model

San Diego Model

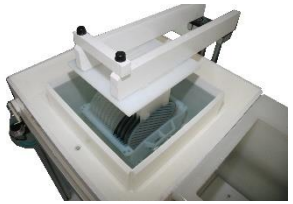
Caribbean Model

Vienna Model

Ludovica Model

Eucalyptus Model

Bern Model



Aconcagua Model

DEFLASHING NEW
Water-jet conveyor

Elbrus Model

Kilimanjaro Model

SEMICONDUCTOR Front-end | SEMICONDUCTOR Back-end | PHOTOVOLTAIC | LABS

List of S.P.M. innovative systems:

- Electrolytic or electroless Cu deposition on leadframes after bonding with copper thread;
- Double face selective electrolytic deposition on leadframes;
- NEW WAY OF WET PROCESSING: SPM Floating system for single wafer up to Ø450mm;
- Single Wafer gold plating (High tickness deposition, till 50µm on Niobio wafers);
- SPRAY PROCESSING: "Ludovica Model" for double/single 6"-8" carrier(s);
- NEW cleaning equipment for QUARTZWARE in vertical version;
- Automatic low thickness wafers transfer system (*wafer thickness 100 µm*) from basket to quartz carrier;
- Vacuum degassing unit at controlled temperature for parts cleaned with acid reagents;
- Indirect ultrasound process/rinse tank;
- Carrier UP/DW agitation inside process/rinse tank without mechanical parts, but using just the fluid.
- LEADFRAMES DEFLASHING: New Water-Jet conveyor
- Wafers selective etch

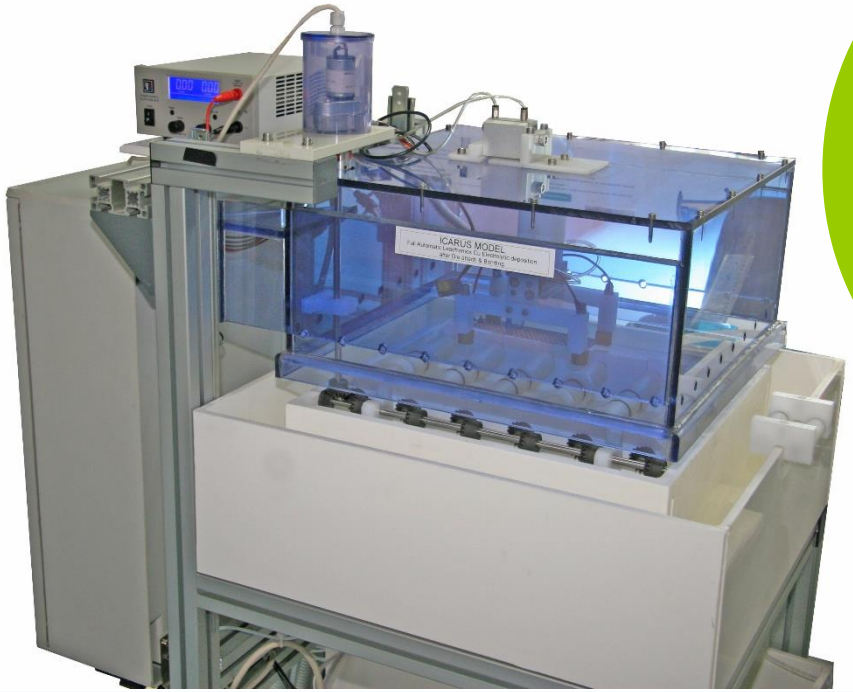
Cu Electrolytic Deposition after die attach / bonding

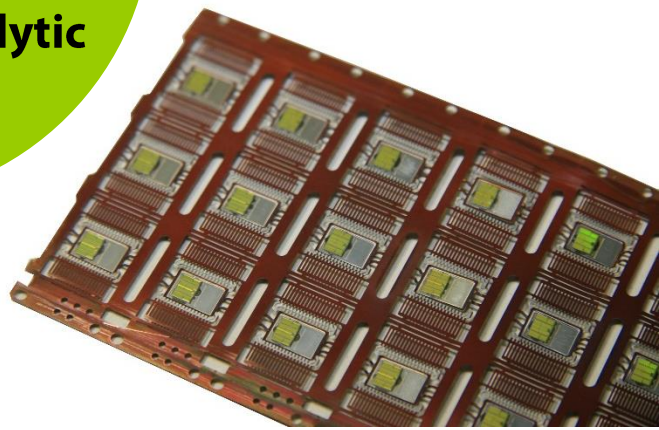
Connection thread between dice and lead frame: actually companies use a **golden thread** of different diameters, according to available device and power.

The problem: **GOLD HIGH COST**

Many engineers approached the use of **copper instead of gold** even if it presents difficulties in bonding welding, loosing in reliability of the results.

SPM suggests making the bonding using the copper thread, making an almost complete coverage of copper by **electrolytic deposition**.

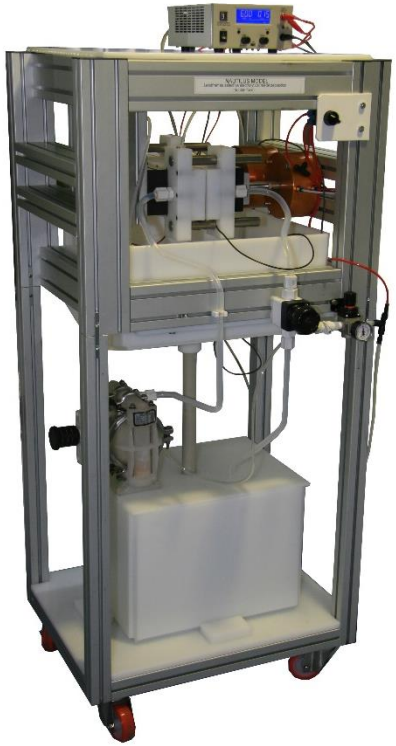




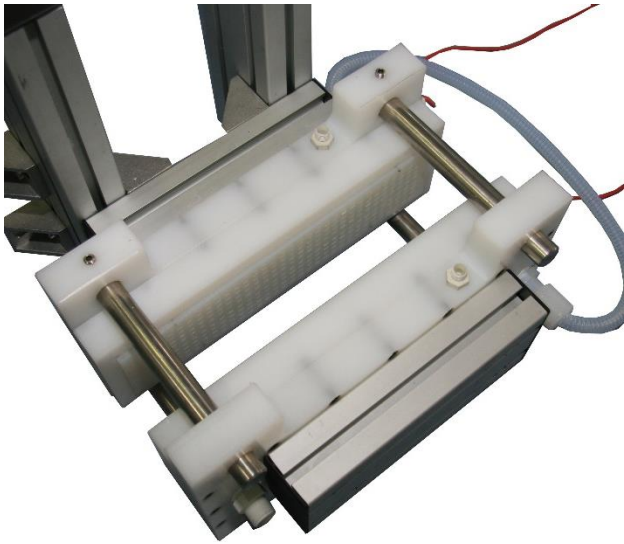
Double Face Leadframes Selective Metal Deposition

It accomplishes **electrolytic metal deposition in selective mode**, on both faces of the lead frame.

Inside each chamber there is an anodic grid in platinised titanium; the connection cable to the power supply comes from this grid, while the cathodic contact comes from the lead frame



There are two silicone masks, realized using the ultimate **3D printing technology**, to obtain leadframe-chip shaped masks that ensure a precise selectivity of deposition. Gasket is encapsulated into the block and is perfectly adherent to its back support, ensuring a total water-tightness.



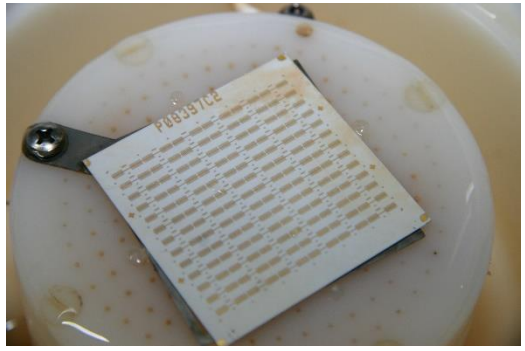
San Diego Model

Single Substrate Double Face Electrolytic "Floating Process"

Find an innovative method to process single substrate instead of the actual complicated and expensive mechanism.

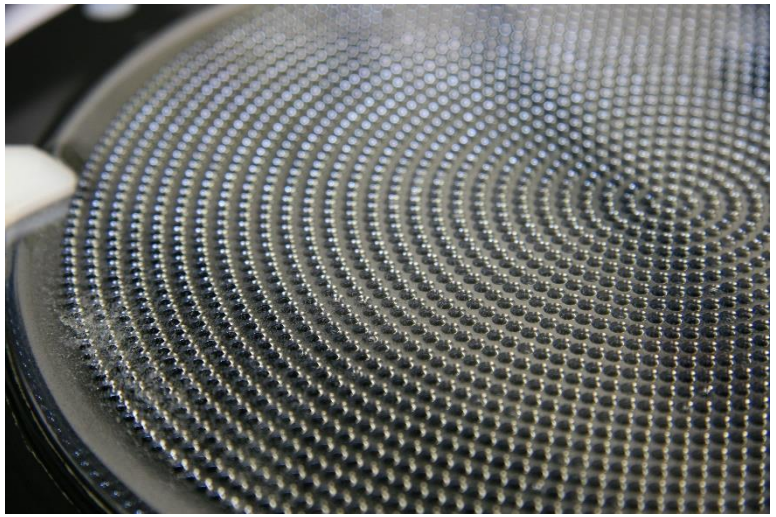
The "floating effect" is obtained thanks to a centrifugal pump that spread the solution from the bottom of the tank to the top.

S.P.M. invented the "floating effect" process. On the top plane of the disc there are waves that create an homegeneous "liquid pillow" that permit to hold up the substrate.



The electrolytic process can be performed with different metals like: **Cu**, **NiFe**, **AgSn**, **Au**, **PbSn**, **Sn**, **Ni**, ecc…, just changing the anodic electrodes.

Single Wafer "Floating Process"



The "Floating effect" permits to liquid to keep a constant level and a ***perfect homogeneity*** *of chemical distribution.*

With the floating technology used for wafers 4"-8", for the Si cells 125x125 and 200x200 and for substrates 5"x5", we have found a very interesting and positive solution for Si wafers 450mm.

floating single face technology it will be possible to do all the processes for Semiconductor manufacturing, like: **oxide etch, metal etch and electrolytic processes**.

It's possible to process one side only of the wafer without any need of masking.

Automatic Vertical quarz tubes cleaner

Process tubes used in semiconductor industry (thermal processes **APCVD**, **LPCVD**) require preventive maintenance when the process purity degree cannot be assured anymore caused by tube walls incrustations.

Vienna Model is an equipment designed to perform the vertical **quartz or silicon carbide** tubes cleaning. Based on the tool configurations it's possible to load tubes with different length and diameters *without any conversion operations needed.*

MAIN ADVANTAGES:

- Reduced consumption of chemicals
- Cancellation of vapours towards the exterior
- Absolute safety for operators
- Repeatability of clean up processes
- Non contamination
- Reduction of H2ODI consumption
- Reduced lay out problems (in height)
- Possibility to be installed in clean room

Ludovica Model

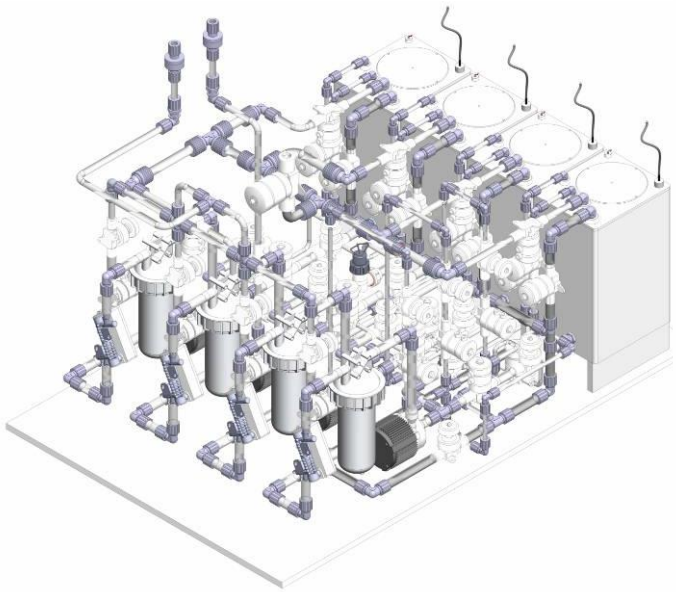
Spray Processing Equipment

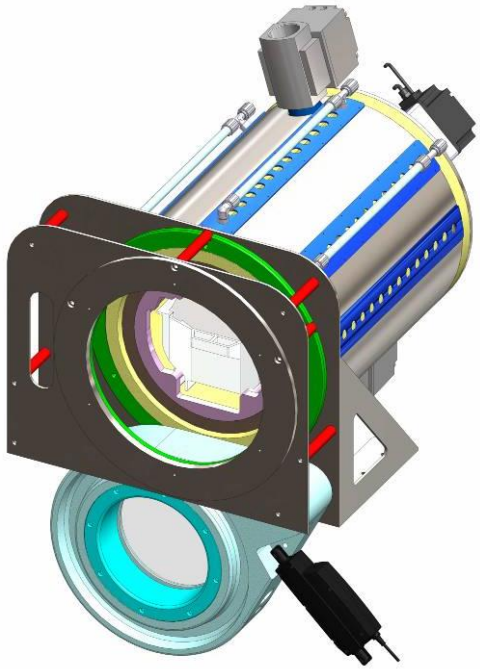
Ludovica Model is a spray processing equipment. It can be configured in different version tanks to its modular development.

The innovative design of the chamber permits to process wafers also in static mode.

Ludovica Model is composed by a PTFE chamber for single/double 6-8" inch carrier(s).

A *servomotor* rules the rotation of the internal rotor and that permits a perfect uniformity of wafers attach.





Double 8" carriers dryer (standalone or integrated into wet benches)

S.P.M. produces dryer since long time for integration into full automatic wet benches or for standalone applications.

Looking at different opportunity at the end we found the solution to add 4 heaters that, like an oven, heat up the tank.

The dryer tank is realized in SS316L in order to permit the perfect distribution of the heat. To avoid problems of corrosion of the stainless steel, the tank is **fully coated with a special PFA layer of 100µm**.

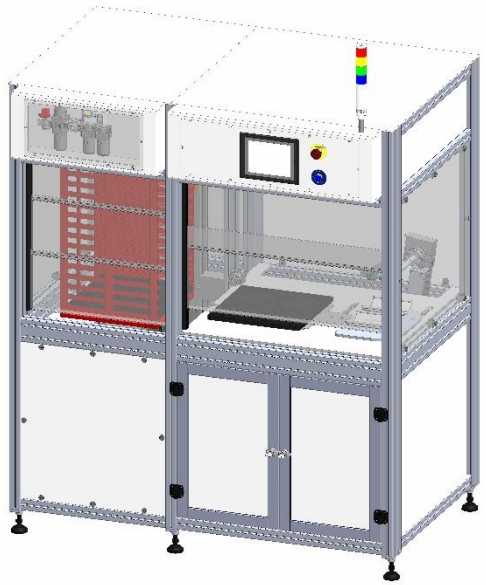
All components used for N2 treatment are fully made in SS316L or PFA material in order to warrant any contamination of the process in term of particles.

The dryer is designed with an automatic cover that can be electrically or pneumatically controlled (for ATEX rules).

Flexible thin wafers transfer system from basket(s) to quartz carrier(s) and vice versa

Handling flexible thin wafers is very hard for operators and require long time to load quartz carriers.

S.P.M. developed a new system for flexible thin wafer transfer from 4 positions baskets to quartz carrier.



The system can be configured in three versions:

- STANDARD (MANUAL BASKET AND CARRIER LOADING)
- MULTIPLE BASKETS MANAGEMENT (MANUAL CARRIER LOADING)
- FULL AUTO: MULTIPLE BASKETS + MULTIPLE CARRIERS MANAGEMENT

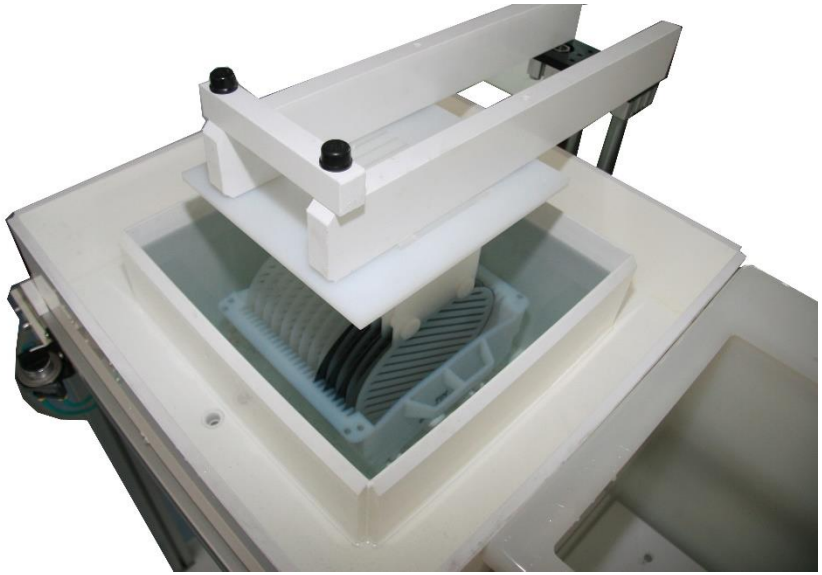
Automatic masking system for 8" Wafers Electroless Palladium deposition

This prototype has been invented in order to provide an innovative method for **palladium deposition** on Si wafers.

The idea was to create special mask that cover the wafers in specific points. While the **electroless deposition** is active, a special rotor made in PTFE starts rotating wafers allowing a perfect deposition homogeneity

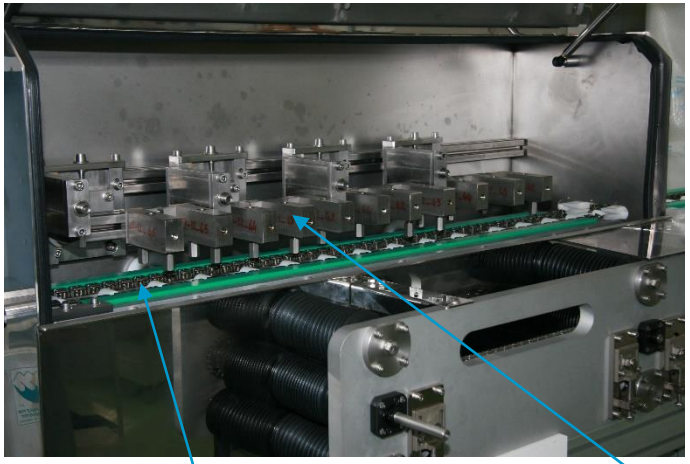
The main advantage of this prototype is that are not required any operation in order to mask wafers.

Operator has only to load the carrier with 12 wafers instead of 25, leaving 1 free space between each wafers. This space is occupied by the mask that is inserted descending automatically from the top of the process tank.



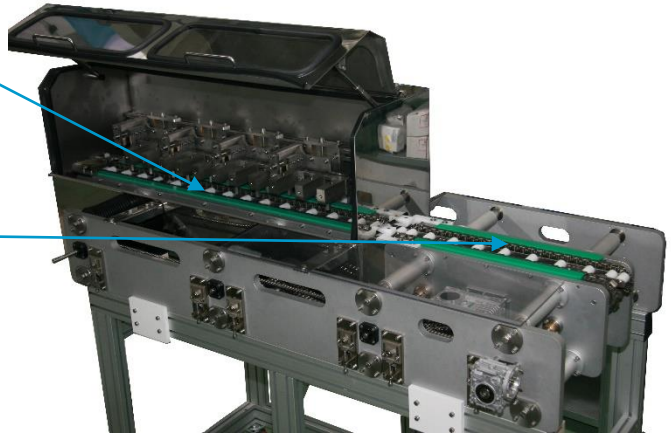
DEFLASHING NEW
Waterjet Conveyor

Innovative Waterjet leadframes deflashing conveyor



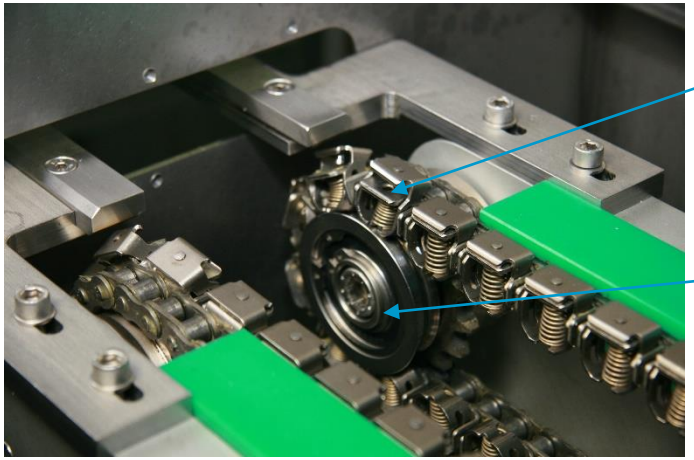
NEW: easy to exchange rollers support

NEW: Separated conveyor for dryer



NEW: Gripper chain

NEW: Multiple Nozzle Blocks



NEW: Gripper chain for a non-stop loading

NEW: Special pulley for gripper chain automatic openiong at load and unload

Waterjet section consist in several components that permits to spread Hi-pressure water on leadframes in order to complete the deflashing process. After the deflash, leadframes are dried and moved on the unload section.

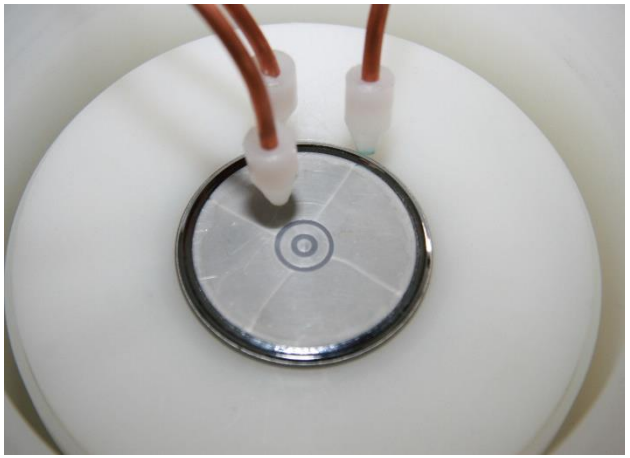
AUTO-SIZING containment GUIDES thanks to a dedicated servo-motor and specific software management

Automatic selective spray etching of metallic discs

System purpose is etching of semiconductor devices:

- Surface cleaning from mechanical and absorption contaminations
- Elimination of disturb layer of semiconductor after mechanical treatment
- Getting preset thickness of semiconductor
- Determination of p-n junctions

Semiconductor element is placed to spin vacuum chuck for etching. Back side of element is rinsing with Di-water. Etcher spray has no contact with element surface but bevel center only. Another nozzle flows Di-water directs to bevel and electrode surface simultaneously.



Innovative way of carrier agitation into process and rinse tanks without mechanical parts

This prototype has been developed to provide an easy way of carrier agitation without mechanical parts.

That means: no metallic parts -> no process contamination.

The carrier movement is exclusively made tanks to fluidic movement.

Examples of possible movements:

- Carrier **UP/DW movement 20-30mm** at controlled frequency
- Carrier **total extraction/Insertion** into the tank allowing manual or automatic tank load-unload.

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