

Market consultation – Final Report 2025

for: Auto Wet Bench- and Wet Bench Lift off tools

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TNO aims to procure a fully automated volume production wet-etching system for etching 6" InP wafers, supporting multiple chemical- and rinse baths and drying stations, and has gathered comprehensive market insights through a formal market consultation through formal responses to a market consultation document and formal clarification meetings. The information obtained may be part of a formal tender process and TNO will determine the most suitable tender procedure for acquiring the Auto Wet bench (**TNO29**) and Auto Lift-off tool (**TNO44**).

TNO is looking for several fully automated volume production wet-etch systems that can support multiple chemical baths, rinse baths and wafer drying stations. The tool(s) must be capable of handling 6" (150 mm) InP wafers supplied in cassettes. The wafers are 675 µm thick and are double sided polished. The wafers are dry when entering the system and should leave the system dry. The current process flow contains a total of 16 etch baths and 11 rinse baths. The chemicals include (Buffered-) Hydrogen Fluoride ((B)HF) acids, Hydrogen Peroxide (H₂O₂)-based acids, Hydrochloric (HCl)-based acids, and Phosphoric (H₃PO₄)-based acids in different concentrations. There are also a number of organic benches using common solvents such as Isopropanol and Acetone. We are looking for configurations that optimize cost, floor space, service-ability and ergonomics. The system should have an automatic chemical delivery system that facilitates mixing, filling and draining of chemicals from supply tanks and to re-cycling tanks located in the sub-fab. Some of the chemical baths need to be temperature controlled at slightly elevated temperatures (40 deg. C). Some baths will require monitoring of physical and chemical parameters such as temperature, pH, refractive index, conductivity, etc.. The system should support drying the wafers. Additionally, TNO is looking for an automated system that can be used for metal lift-off processes. This should be a separate system to avoid metal contamination. The vendor must be able to show a proven track record of fully automated processing of InP wafers up to at least 4" and/or another compound semiconductor wafers up to at least 6". Experience with photonics applications is preferred. The vendor must also be able to support operator training, support in setting up and tuning the processes, and offer short response time on tool maintenance and repairs.

Based on above requirements, TNO has prepared below questions for the participant. Please find the summary of the market consultation:

1. What system configurations does the vendor has available that can handle 6" InP wafers?

Most of the companies can handle 6" InP wafers. Some companies deliver standardized equipment (depending on volumes) while other companies can build equipment upon specifications of TNO (custom made). Fragility of the wafer is known to be an important issue. A modular automated wet bench with or without separate load- and unload stations, recirculated or stagnant baths, chemical or temperature controlled baths (process- and rinse tanks) and chemical distribution- and waste systems.

2. What track record does the vendor have in handling InP wafers of 4" or larger?

Most of the companies have experience with handling InP wafers of 4" and deliver manual, semi-automated or fully automated wet benches.

3. What track record does the vendor have in photonic IC applications?

Companies have experience in photonic IC applications and can offer cassette-to-cassette solutions. All companies offer 'dry-to-dry' processing, automatic spiking, chemical distribution systems and waste disposal systems.

4. Are all chemicals/processes described above supported?

In general, all companies have expressed that they can support all chemicals/processes. Most of the companies are requesting more detailed specifications of TNO (e.g. processes, type and number of baths (dipping's) required etc.).

5. What are the typical uniformity levels that the vendor can guarantee?

All companies can guarantee the typical uniformity levels. Typical etch uniformity is < 3%.

6. What experience does the vendor have with metal lift-off processes?

Only a few companies have experience in metal lift-off processes in combination with automatic wet bench processes. Additional one company offers the possibility to handle single wafer processing and batch processing in the same environment. TNO has preference for two separate tools.

7. What chemical handling system does the vendor use?

All companies can offer different chemical distribution- and waste systems which facilitates mixing, filling and draining of chemicals. All companies use stainless steel material for solvents and plastic material for acids and offer several ways of filling solutions to the tool. Different drum types are offered by suppliers.

8. What kind of monitoring capability does the vendor offer?

All companies have a standard monitoring capability with their equipment including recipe scheduler. Some companies offer additional features in monitoring- and software solutions (examples are concentration measurement of chemicals, flowmeters, temperature control, refractometers, gas pressure monitors, resistivity- and conductivity monitoring, camera's etc.).

9. Does the vendor support integration in factory automation software (i.e. SECS/GEM)?

All companies offer SECS/GEM integration as a standard option.

10. Which equipment lay-out for wet processing does your company offer?

The set up of the wet benches has to be compliant with the cleanroom floor space requirements in the fab of TNO. Some companies can offer the set up of wet processing tools in a flexible manner especially in case of custom-made equipment. The fab will be producing 10.000 wafers annually where layout and space occupation is a critical element.

11. Does the vendor have an European/Benelux service organization in place?

All companies have an European or Benelux service organization with own service engineers in place in an acceptable distance from the future TNO factory. Production is done in Europe or the United States. A limited number of companies offer a variety of service levels for maintenance including digital remote servicing.

12. What is the expected delivery time your company in normal circumstances offer?

Typical delivery time has a variation between 6 and 12 months (depending on supplier).

13. What are the estimated equipment prices for budgetary/purposes?

Estimated total budgetary costs for automated wet benches and/or metal lift-off tools have a high variation depending on standard tools or custom made equipment ranging up to \$ 15 million. Costs are depending on e.g. the number of baths required, the number of tanks required and other specifications needed. A few companies are in alignment with the budgetary constraints of TNO's project.