Bio

Optical & Laser Technologies

モル株式会社
MOL Solutions Inc.
www.mol-solutions.com

About MOL Solutions

MOL Solutions is a leader in innovative optical and laser inspection and measurement technologies, specifically designed for high-volume, in-line mass production environments.



The Future of Precision

We don't just process materials; we redefine them. Through Laser Bionics Engineering, we create 3D microstructures that modify surface properties—from electrical conductivity to biocompatibility—solving the challenges of nature through light.

Global Excellence in R&D

Advanced Optical Analysis
Utilizing close-view optical inspection to capture micro-objects beyond the reach of conventional high-speed cameras.

Semiconductor Precision
Specialized in wafer thickness, post-cutting defects, and surface warpage/roughness measurement.

Micro-Structure Inspection
Reliable detection for ABF substrate via-holes and micro-drilling defects.

Laser Bionics: Material Evolution

The Light Pencil
Drawing 2D or 3D microstructures to modify material geometry and inherent properties.

Surface Modification
Overcoming the limits of conventional methods to solve complex surface nature problems.

Enhanced Performance
Electrical Conductivity & Bonding Strength
Heat Transfer & Anti-reflection
Hydrophilicity & Biocompatibility

Background: Miniaturization of Droplets and Dispensing Methods



mL - µL

Dispensing Methods

Syringe & needle Pipettor

Dispensers (air-pulse, screw)



nL

Dispensing Methods

Dispensers (valve type, jet type)

Acoustic ejection

Inkjet



pL

Dispensing Methods

Dispensers (jet type)

Inkjet

MOL Solutions
—Integrated Solution- Click Jet + NanoStrobeX

- Disposable nozzle per solution (quick swap for different fluids)
- One-click nozzle change
- 3D analysis of every single droplet
- Reference-grade, high-precision droplet metrology/traceability



- One-click exchange -



- Droplet analysis unit -



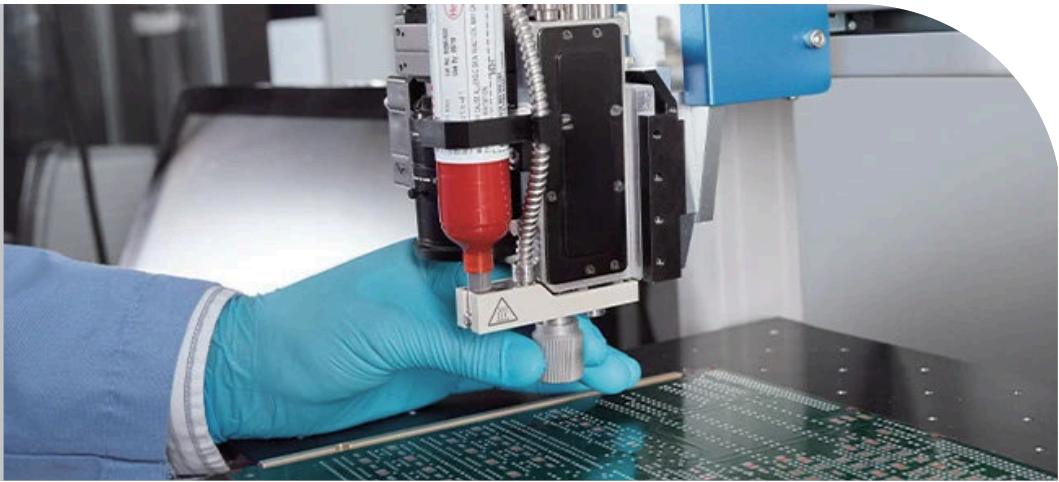
- Single droplet dispensing -

- 2-axis droplet 3D analysis -

Pain points: nL / pL Dispensers

—Miniaturization of conventional dispenser and/or inkjet present several inherent limitations and drawbacks.

- Accuracy and Precision Limitations: Even advanced droplet ejection systems (existing nL/pL dispensers) can introduce errors, especially at ultra-low volumes. These inaccuracies may be amplified by user technique or environmental conditions.
- Lack of Referencing: Except for a few extremely expensive devices, most systems do not monitor the actual droplet volume or morphology. Thus, no true reference to the dispensed droplet exists. Stated accuracies are only valid under ideal conditions.
- Maintenance and Calibration: Existing dispensers require frequent calibration and maintenance to achieve nominal precision. Each change of liquid type also necessitates recalibration.
- Contamination Risks: Dispenser heads are extremely costly, making disposable use impractical. Frequent cleaning leads to risks of contamination—unacceptable in biomedical and pharmaceutical fields.
- Operational Complexity: Numerous parameters must be adjusted for stable droplet ejection. Operation heavily depends on the user's expertise, reducing data reliability and reproducibility.





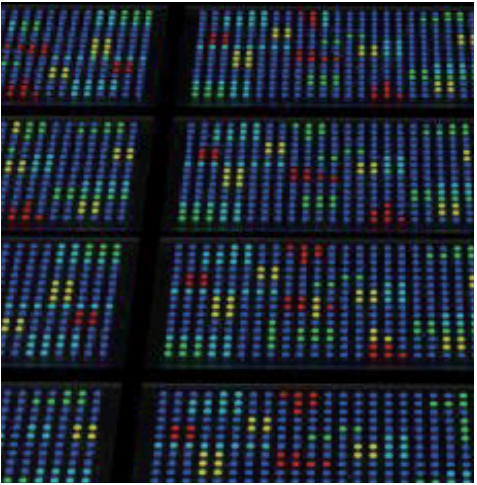
Application fields1: From Research to Production in Handling Biological Samples

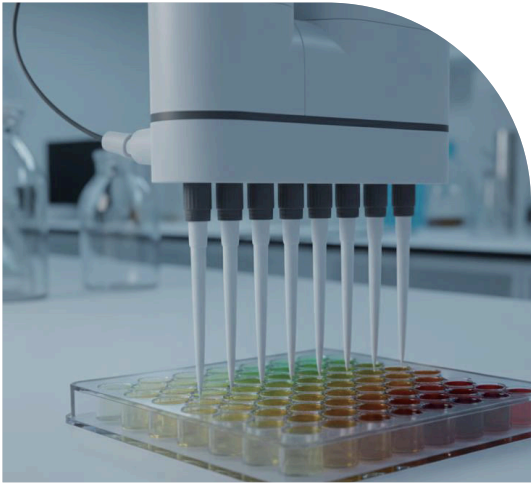
POCT (Point-of-Care Testing): from R&D to manufacturing

Avoids sample cross-contamination
nL/pL-scale droplet measurement and logging
Parallel dispensing of multiple ligands
Single-step fabrication of lateral-flow test chips

Lab-on-a-Chip research

Arbitrary positioning and volume-specified dispensing
Low-shear dispensing (≤ 1/5 of conventional systems), gentle on cells
Disposable dispensing head per operation to eliminate contamination risk





Application fields2:
From Research to Production in Handling Biological Samples

Drug screening

Droplet imaging ensures target well volume for each position

Precise per-well volume control

Compatible with diverse substrates (well plates, chips, Petri dishes)

Microarray printing

Up to 24 reagents dispensed in parallel (e.g., amino-acid solutions)

Microneedles: applicable for drug coating onto microneedle arrays

For each solution, feed tubing can be replaced independently





CikckJet

for Nanoliter Liquid Handling

- Nozzle-cartridge combination ensures 100% cross-contamination-free operation
- Nozzle cartridge can be exchanged easily with just one click and is ready for immediate use
- Patented nozzle design and ejection technology
- Volume range: 20 nL - 20 pL, adjustable through X-changable cartridges and power control
- Shear force during droplet ejection is less than 1/5 of that in conventional dispensers



10 nL



1 nL



0.1 nL

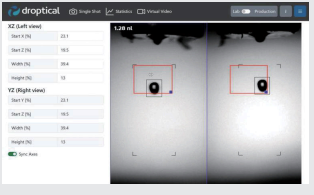
Extremely simple operation + Disposable heads + Low shear force

- 100% contamination-free thanks to the quick-change system of the nozzle-cartridge combination (ClickTube)
- Exchange of ClickTube within seconds, without any tools
- Drop volume range: : 20 nL - 20 pL
- Plug'n'Play Controller, VoD®(Volume-on-Demand) ready with NanoStrobeX camera system
- Reliable and long-lasting piezo drive (no air pressure required, simplifying use)
- Easy integration into mass production lines or dedicated research equipment
- Suitable for low-viscosity dilutions, particle (cell) suspensions, emulsions, tinctures, elixirs, etc.
- Compared to conventional dispensers, shear force applied to the liquid during ejection is reduced to less than 1/5

NanoStrobeX

for Nanoliter Liquid Handling

- Ultra-compact optical observation system (only 45 mm)
- Observes droplets from two orthogonal axes, enabling full 3D droplet analysis
- Captures and measures every droplet ejected from ClickJet
- Measures not only the main droplet but also satellite droplets
- Enables closed-loop dispensing control in combination with the VoD® system
- Can be integrated not only with ClickJet but also with most other dispenser systems





Extremely simple operation + High referencing of all droplets

- 3D droplet inspection on-spot and on-demand
- Real-time measurement of every single droplet: inline inspection with high-reference reliability
- 100% traceability of each droplet (volume, speed, angle deviation, satellite droplets if present). Software GMP validation under preparation
- Closed-loop dispensing control when combined with the VoD® system and ClickJet
- Compatible with a wide range of jet spotting valves from various manufacturers
- Intuitive application interface, flexibly adjustable to each jet spotting valve

3D Optical Closed Loop Dispensing System

VoD®

Volume On Demand

Don‘t care about the dispensing process





control

measure

VoD® Raedy

VoD® Ready with NanoStrobeX

3D Closed Loop

Optical Closed Loop Dispensing

Conceptional product



DispoJET-handy

- Manual nL/pL drug dispensing with the intuitive feel of a conventional micropipette
- Compact, erfonomic, and one-hand operable design for flexible feasibility studies
- Upgradable to a fully automated XYZ system
- Seamless upgrade path from manual research to fully automated XYZ stage systems
- Every droplets is captured with simple strobe system





DispoJET-research

- Arbitrary-position dispensing with specified volume
- Complete per-drop traceability (position, images, measurement results)
- Supports up to 2 nozzles installed
- Compatible with multiple substrates (well plates, chips, Petri dishes)
- Benchtop system, cleanroom-ready
- Logs all dispensing data and conditions during experiments for downstream traceability



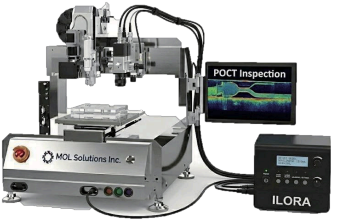
DispoJET-24

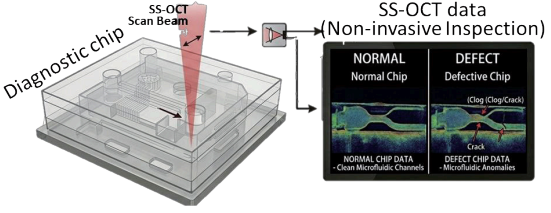
- Arbitrary-position dispensing with specified volume
- Complete per-drop traceability (position, images, measurement results)
- Supports up to 24 nozzles (e.g., multiple amino-acid solutions)
- Integrable into POCT chip production lines
- Remote monitoring of dispensing status and production conditions
- Per-batch tubing replacement to ensure quality
- Traceable observation and measurement results for every batch of droplets

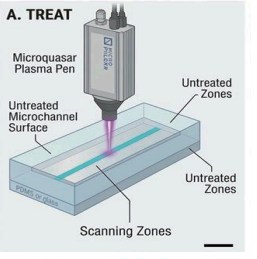
Conceptional product

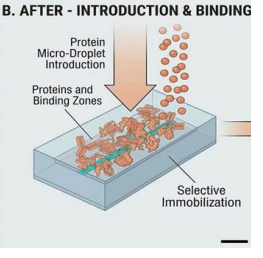
Inspection: ILORA system

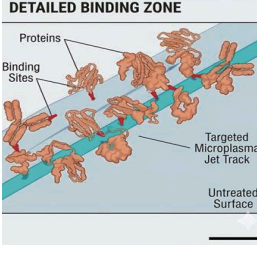
- Non-invasive plasma surface activation of diagnostic chips for reagent binding
- Mask-free track creation without the need for expensive MEMS or cleanroom facilities
- Selective immobilization of proteins, DNA, and allergens onto targeted micro-zones
- Automated XYZ stage capable of activating surfaces of any complex shape or geometry
- Precise boundary control to prevent liquid spreading for accurate pL/nL handling







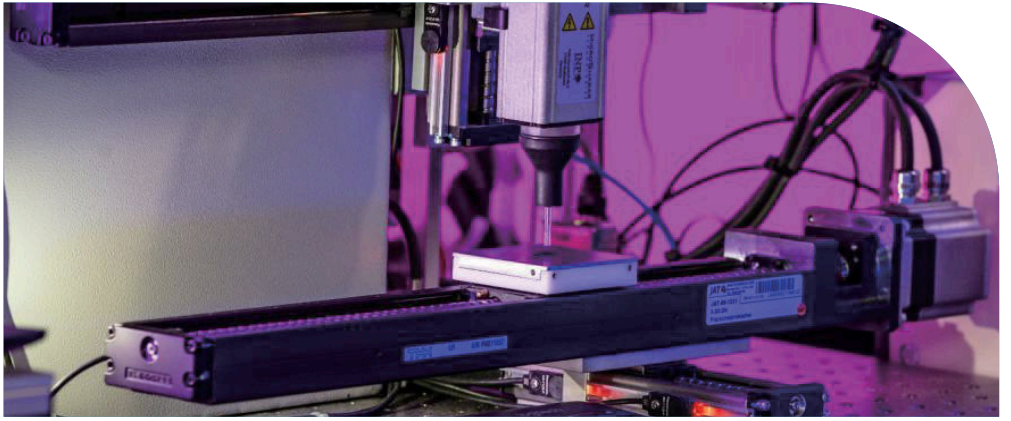






Pre-dispensing : Micro-Quasar

- Non-invasive plasma surface activation of diagnostic chips for reagent binding
- Mask-free track creation without the need for expensive MEMS or cleanroom facilities
- Selective immobilization of proteins, DNA, and allergens onto targeted micro-zones
- Automated XYZ stage capable of activating surfaces of any complex shape or geometry
- Precise boundary control to prevent liquid spreading for accurate pL/nL handling



Micro Plasma

High Resolution Plasma Printer

Versatility
Activation, thin film deposition, fine cleaning and etching

Precision
Simple and complex patterns, 2D, 2.5D and 3D; gradients possible

Multifunctional
Open precursor system for polymer-, metal-, metal- oxide, hybrid-layers deposition

Sustainability
Reduce waste and harmful chemicals

Capabilities & Functions

Activation
Surface energy modification for bonding, printing, and coating applications.

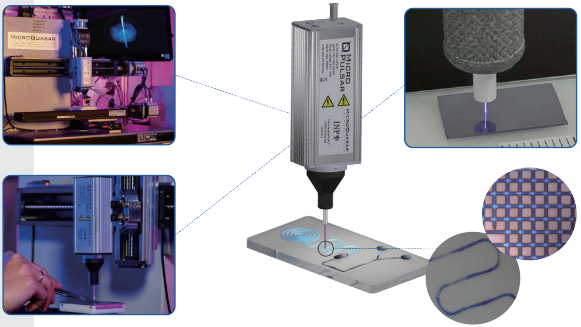
Thin Film Deposition
Deposition of polymer, metal, metal-oxide, and hybrid layers using open precursors.

Fine Cleaning
Removal of organic contaminants at the micrometer scale for surface preparation.

Etching
Selective layer etching for microstructuring and fine pattern creation.

Microstructuring
Micro- and nano-texturing to create tailored functional surface properties.

Additive Manufacturing
Integration with 2.5D and 3D additive manufacturing for high-resolution features.



35 µm Minimum Linewidth

10×–80× finer than similar plasma solution

Micro Plasma provides the finest linewidth resolution for maskless plasma treatment available in the global market.

Market Applications

Life Sciences & Medical Devices
Biosensors, microfluidics, and medical device surface activation.

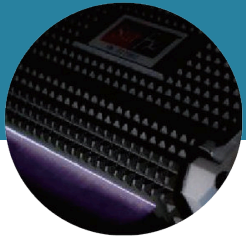
Electronics & Semiconductors
Thin-film electronics, flexible circuits,and heterogeneous integration.

Advanced Materials
Tailored surface functionalities for advanced material development.

Research & Academia
Microfabrication research, surface science, and process development.

Photonics & Energy
Photonic devices, energy storage, and functional surface engineering.

Applications



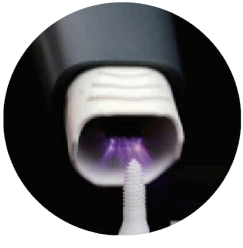
Surfx 10-100 mm



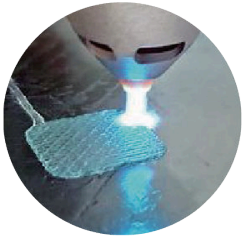
plasmatreat 1-5 mm



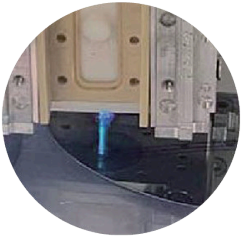
MPG 2 mm-500 µm



Relyon Plasma 5 mm

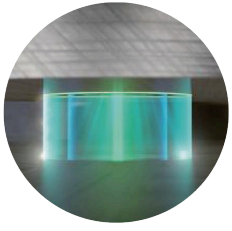


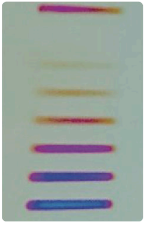
Nadir s.r.l 1 cm2

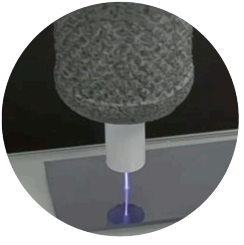


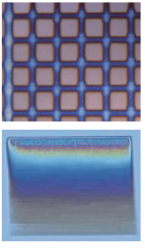
Space Foundry 700 µm

Technology Comparison









Other technologies ALD*

Atlant3D DALP®

- Min. resolution: 400 µm
- Temperature: 120 - 300 °C
- 3 mm line, 40 nm: 3 – 4 min Gradients possible

Our technologies

Micro plasma

- Min. resolution: 100 µm
- Temperature: 30 - 40 °C
- 3 mm line, >40 nm: 3 seconds! Gradients possible

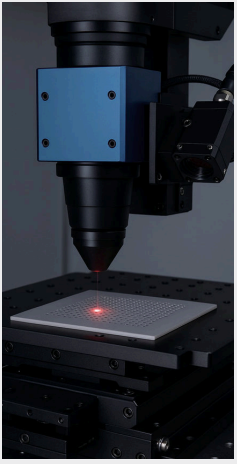
Feature	Plasma Jets (Market)	ALD (Atlant3D)	Micro Plasma
Min. Resolution	100 - 10,000 µm	400 µm	35 µm
Temperature	30 - 40 °C	120 - 300 °C	Low (< 40 °C)
Speed (3mm line)	3 seconds	3 - 4 minutes	Fast / Selective
Sustainability	High Gas/Power	Moderate	Ultra-Low Waste

TNCHNOLOGY

OPTICAL & LASER

Next-Generation Laser Processing Technology

Ultrafast laser via processing technology for advanced semiconductor materials and high-precision microfabrication applications.





Precision Dispensing Technology

Real-time optical droplet monitoring technology for ultra-precise, stable, and high-speed dispensing control applications.

3D LSTR Technology

Laser-engineered microstructure technology for enhanced bonding, wetting behavior, thermal management, and surface functionality.



Note_

Date: / /

MOL SOLUTIONS Inc.

As manufacturing advances toward finer structures, tighter tolerances, and higher throughput, precision laser and optical metrology technologies have become indispensable. MOL Solutions delivers the measurement accuracy and laser microprocessing capabilities needed to support this technological transformation in real production environments.

Precision in Every Step

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Optical & laser measurement
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