ocean

IN SITU LIQUID SOLUTIONS FOR TEM PLATFORMS

Solutions for In Situ Microscopy

THE OCEAN SERIES

Observe the real-time dynamics of materials and biological samples in a controlled liquid environment.

OCEAN FEATURES

Absolute TEM safety.
Customize your experiments.
No cross-contamination or clogging.
Static & flow modes.

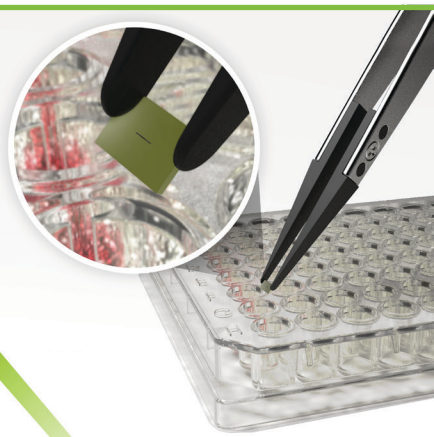
DENS solutions

IN SITU TEM WORKFLOW

TURN YOUR TEM INTO A NANO-LAB

NANO-CELL SAMPLE PREPARATION

The Ocean Series consists of a dual chip Nano-Cell that sandwiches two chips together to form a microfluidic compartment. Samples can be loaded or grown directly on the chip in the field of view, removing the need to flow the sample into the cell or drying, fixing and freezing.

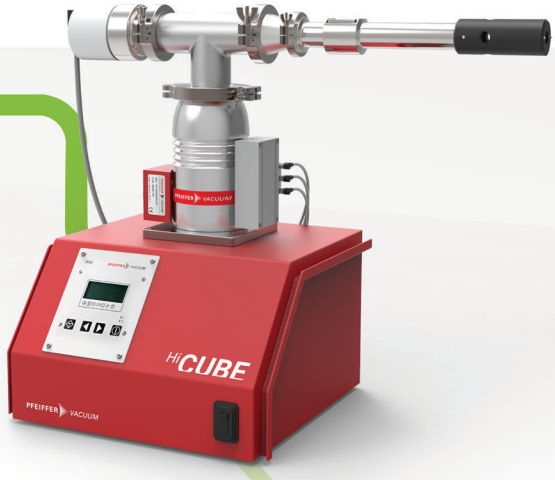


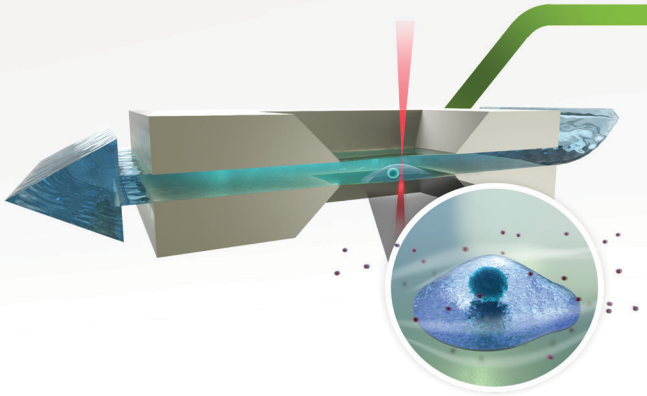
LOADING THE NANO-CELL

The Nano-Cell is loaded in a precision made slot that ensures the electron transparent windows remain aligned and ready for safe and reliable experiments.

TEM SAFE LEAK TESTING

The Ocean Series is equipped with a high-vacuum leak tester to safeguard the integrity of the TEM column. This system certifies that the holder is completely sealed from any leakages and is vacuum compatible.





REAL-TIME LIQUID-PHASE PROCESSES

The Ocean Series enables researchers to achieve nanometer resolutions and image the real-time dynamics of a sample using static and flow modes in a fully hydrated Nano-Cell. The Ocean Series provides the understanding of fundamental processes and opens the door to a range of exciting new applications.

In Situ TEM Liquid Research

Historically, the low magnification possibilities of the light microscope have limited researchers' understanding of samples. Investigating in their native environment or observing the complete reaction process has always been the key to better scientific understanding. Almost 80% of all microscopy investigations are carried out with light microscopy exhibiting a limited spatial resolution. Scientists' desire to study samples of dimensions smaller than 20 nm has resulted in the increased interest into electron microscopy. However, standalone transmission electron microscopes are limited by stimuli free environments and has further restricted researcher's ability to a number of applications. This limitation is now lifted giving TEMs additional value in being able to image real-world sample dynamics in a liquid environment.

Life Sciences

The sample damaging technique of drying, fixing and freezing has limited researchers' ability to further understand a range of bio related samples. Enabling native environment research, the Ocean Series removes the need for these techniques and allows nanometer resolutions to be obtained while preserving the original morphology of the sample. Additionally, the ability to grow bio samples directly on the chip in a multi-well further highlights the Oceans Series value in allowing scientists to understand their sample in the native environment.

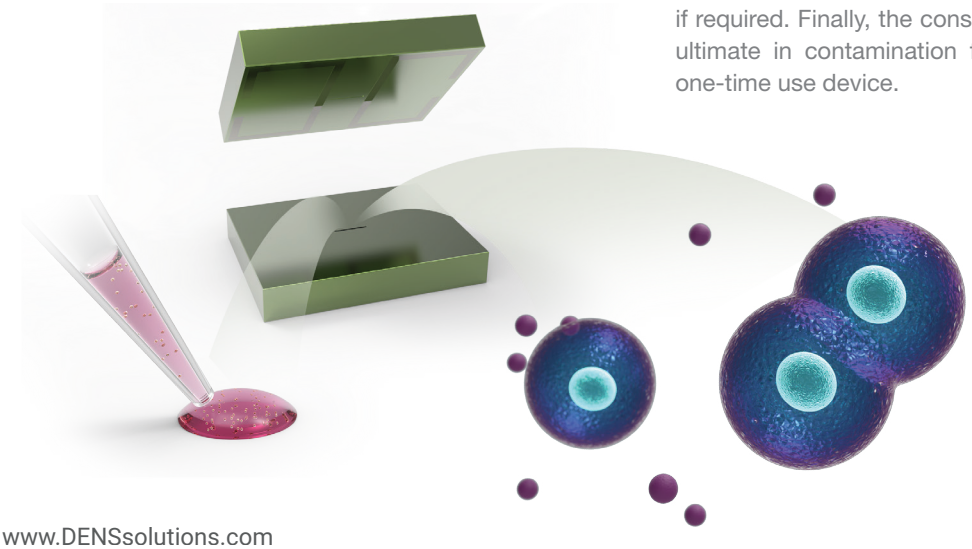
TEM Safety

Critical to all forms of in situ research is upholding the safety and security of the TEM column. The Ocean Series is equipped with an advanced leak tester that tests vacuum compatibility and guarantees that no liquid will escape once inserted into the TEM.

Each Nano-Cell is made from silicon nitride and has been rigorously tested for membrane strength under high pressures. The robust electron transparent windows have been optimized to prevent mechanical failure from changes in pressure and alternating flow rates.

Chemistry & Materials Science

The unique dual chip Nano-Cell offers researchers' the ability to observe the complete chemical reaction, imaging each critical moment of real-time dynamics. The Ocean Series allows the liquid conditions to be regulated for total control of the chemical interactions and enables optimization of processes and properties of the material.

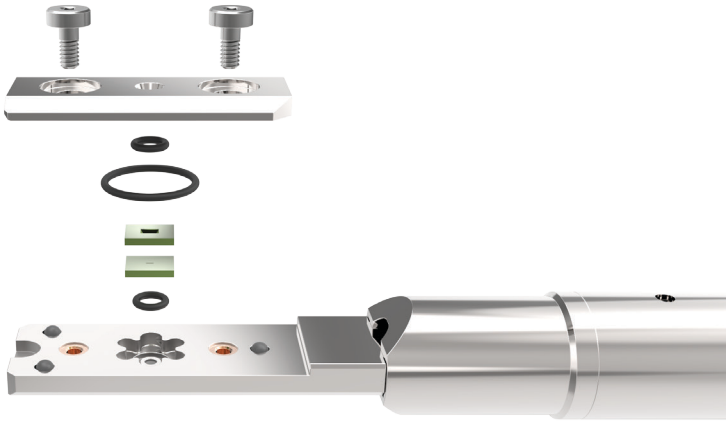


Replaceable Tubing & Tip

Ensuring a clean environment, free from contamination and without the risk of clogging is critical to a user's results. The Ocean Series' unique design allows for all inner tubing and tip to be completely removed from the holder and replaced with new uncontaminated replacements, guaranteeing a clean experiment. The tip of the holder can be detached from the holder for easy and thorough cleaning and replaced if required. Finally, the consumable Nano-Cell provides the ultimate in contamination free research through being a one-time use device.

Ocean In Situ TEM Liquid Series

The Ocean Series is the complete solution including syringe pump and leak tester for full protection of the users TEM. As an easy-to-use cost effective add-on to your TEM, the Ocean Series provides all laboratory users with the opportunity to understand more about their sample in a fully hydrated liquid Nano-Cell.



"Empower yourself to observe the real-time dynamics of materials and biological samples in a controlled liquid environment"

Key Features of the Ocean System

Liquid-phase Processes

Observe the real-time mechanisms that occur in liquid-phase processes.

Native Structure of Your Sample

Image your sample in its original liquid environment without the need to drying, fixing or freezing.

Improve Imaging Resolution

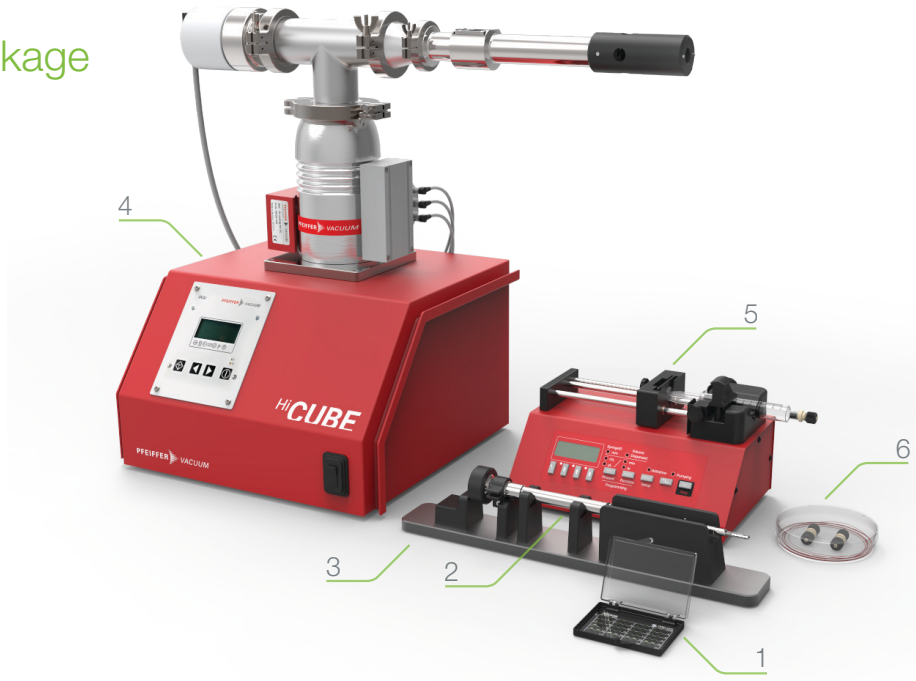
Improved imaging spatial resolution as compared to conventional light microscopic studies.

No Cross-contamination or Clogging

Ensure reliable results with easy replacement of all holder tubing, holder tip and Nano-cell.

Complete 'Plug & Play' Package

1. Nano-Cells
2. Ocean Holder
3. Holder Stand
4. Leaktest Tool
5. Syringe Pump
6. Tubes & Connectors



Nano-Cell Dual Chip Technology

The Nano-Cell acts as the sample carrier and consists of two chips, referred to as the blank and spacer chips. These chips are sandwiched together to form a liquid compartment Nano-Cell. Fabricated from silicon nitride, each Nano-Cell is chemically inert, biocompatible and the spacer chip is available in varying thicknesses – e.g. 200nm for nanoparticles and 5mu for cells. This customization to the users experiment allows for the ultimate control and greatest imaging resolution. Additionally, the dual chip system allows for users to locally functionalize the surface of the windows, as well as cleaning and plasma treat the area of interest. Some advantages include:

Life Sciences

- Grow the sample directly on the chip (e.g. cell culturing on well plates)
- Avoid flowing samples into the device, often resulting in sample damage due to collisions during liquid infusion

Chemistry and Materials Science

- Direct sputtering of material on the window
- Dispense/deposit the sample directly on the field of view, allowing the user to control the amount of sample to be used

Key Features of the Nano-Cell

Optimal Stability

Nano-Cells are fabricated to ensure a stable, chemically inert and biocompatible environment.

Customized Experiments

Control the liquid layer thickness for your experimental requirements due to the available spacer heights.

High Resolution

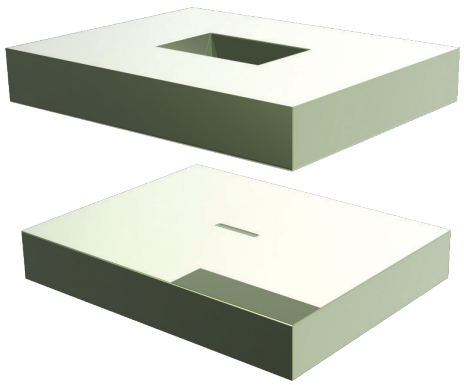
Image hydrated samples in high resolution, eliminating the need to dry, fix or freeze your samples.

Sample Placement

The Nano-Cell allows the sample to be loaded or grown directly onto a chip.

Nano-Cell Specifications

Outer Dimensions	2.00 x 2.60
Window Dimensions	0.050 x 0.40 mm^2 (intended for a thick liquid layer) 0.020 x 0.40 mm^2 (intended for a thin liquid layer) 0.010 x 0.40 mm^2 (intended for a thin liquid layer) 0.40 x 0.010 mm^2 (crossed window)
Thinnest Available Spacer	200nm (suitable for nanoparticles)
Thickest Available Spacer	5µm (suitable for cells)
Window's Thickness	50nm



Application Fields*

(S)TEM experiments in **Chemistry**

- Nano Particles:
  - Growth processes
  - Nanoparticle aggregation
- Self-assembly processes
- Chemotaxis processes

(S)TEM experiments in **Materials Science**

- Understanding of reactions in energy materials
- Addressing microstructures of new materials for energy storage
- Examination of failure modes of batteries during cycling
- Lithiation of anodes and formation of interfacial layers between electrolyte and electrodes
- Examine corrosion processes in steel
- Research on hydrated geological materials
- Applications in petroleum extraction and soil science
- Biomineralization processes

(S)TEM experiments in **Life Sciences**

- Image protein and DNA (dynamic) structures in liquid
- View self-assembly processes and conformational changes of proteins
- Study of membrane protein function in intact cells
- Imaging organelles in bacteria and eukaryotic cells
- Correlative light- and electron microscopy of cells
- Nanotoxicology after nanoparticle uptake
- Study effects of drug delivery in cells
- Virology and oncology studies
- Morphological studies of liposomes and other vesicles
- Microbial Production

* These featured examples are for inspirational purposes yet do not cover the entirety of the application range.

Performance Specifications

	FEI Compatible	JEOL Compatible
		
Fluid Control Method	Syringe Pump	Syringe Pump
Flow Modes	Static / Continuous	Static / Continuous
Liquid Manipulation	Infusion / Withdrawal	Infusion / Withdrawal
Maximum Flow Rate *1	10 µL/min	10 µL/min
Minimum Flow Rate *1	25 nL/min	25 nL/min
Resolution *2	≤ 5 nm	≤ 5 nm
Compatibility (Pole Piece)	ST, XT, T, BioT	HRP, HTP, CRP, HCP
(HR)TEM	✔	✔
(HR)STEM + EELS	✔	✔

*1 Depending on Syringe Pump specifications.

*2 Depending on the liquid thickness provided by the spacer height.

Visit our website

For more information, visit www.DENSsolutions.com

Request a quote

Email your details to Quote@DENSsolutions.com

Main Office

DENSsolutions
Delftechpark 26
2628 XH Delft
The Netherlands
+31 15 260 04 33
info@DENSsolutions.com

Distributors

Austria

LOT-QuantumDesign GmbH
www.lot-qd.com
lotqd_de@DENSsolutions.com

Argentina

Micra Nanotecnologia SA de CV
www.micra.com.mx
micra@DENSsolutions.com

Canada

Angstrom Scientific, Inc.
www.angstrom.us
angstromscientific@DENSsolutions.com

Chile

Micra Nanotecnologia SA de CV
www.micra.com.mx
micra@DENSsolutions.com

China North

KYKY Technology Co., Ltd
www.kyky.com.cn
kyky@DENSsolutions.com

China South

DENS ALTA Technologies Ltd.
www.DENSsolutions.com
DENSalta@DENSsolutions.com

Colombia

Micra Nanotecnologia SA de CV
www.micra.com.mx
micra@DENSsolutions.com

Ecuador

Micra Nanotecnologia SA de CV
www.micra.com.mx
micra@DENSsolutions.com

France

LOT-QuantumDesign
www.lot-qd.fr
lotqd_fr@DENSsolutions.com

Germany

LOT-QuantumDesign GmbH
www.lot-qd.com
lotqd_de@DENSsolutions.com

Israel

Eisenberg Bros. Ltd
www.eisenbros.co.il
eisenbergbros@DENSsolutions.com

Japan

TSL Solutions
www.tsljapan.com
tsljapan@DENSsolutions.com

Mexico

Micra Nanotecnologia SA de CV
www.micra.com.mx
micra@DENSsolutions.com

Nordic countries

BoRAS
www.boras.no
boras@DENSsolutions.com

Peru

Micra Nanotecnologia SA de CV
www.micra.com.mx
micra@DENSsolutions.com

Russia & CIS

Systems for microscopy and analysis
www.microscop.ru
cma@DENSsolutions.com

South-Korea

NAMOTEC
www.namotec.com
namotec@DENSsolutions.com

Switzerland

LOT-QuantumDesign GmbH
www.lot-qd.com
lotqd_de@DENSsolutions.com

Taiwan

DENS ALTA Technologies Ltd.
www.DENSsolutions.com
DENSalta@DENSsolutions.com

United Kingdom and Ireland

LOT-QuantumDesign UK
www.lot-qd.com/uk
lotqd_uk@DENSsolutions.com

United States of America

Angstrom Scientific, Inc.
www.angstrom.us
angstromscientific@DENSsolutions.com

Other countries

DENSsolutions
www.DENSsolutions.com
info@DENSsolutions.com

Australia

AXT Pty Ltd
www.axt.com.au
info@axt.com.au