



HUMMINGBIRD SCIENTIFIC

SEM Liquid

Technical Specs

1400 Series SEM

Number of Inlets	1 or 2 depending on model, single-outlet
Biasing Contacts	3 or 4 depending on model
Tubing Type	Replaceable microfluidic tubing
Delivery System	Variable-speed liquid delivery system
Tip Type	Removable tip
Flow Type	Continuous or static liquid flow
SEM Compatibility	Custom Integration

Contact us for Custom Configurations



How It Works

Hummingbird Scientific's SEM liquid system encloses the sample within a microfabricated liquid cell in the holder tip, which is sealed from the microscope chamber environment by a patented sealing mechanism. The fluid pump and power supply are located safely outside of the chamber. A customizable chamber interface and vacuum sealed supply system provide fluid and power to the tip. Using Hummingbird's two-chip fluid cell, users can prepare their sample of choice using the same methods they would for any other electron transparent membrane substrate. The tip can be swapped between light microscopes, the SEM, and the TEM for cross-correlative studies.

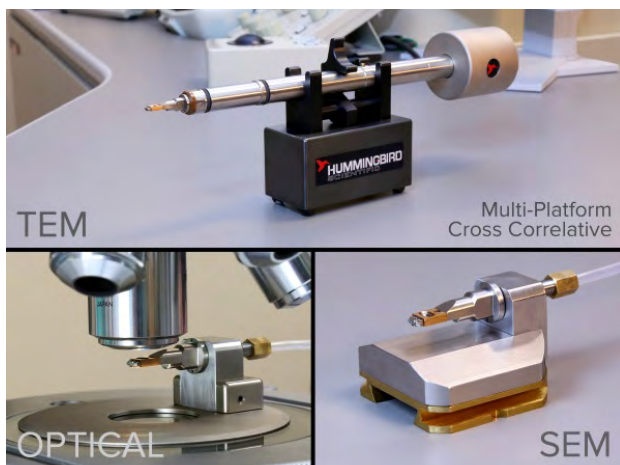
The holder's liquid-cell assembly and safety features protect your SEM's vacuum system from contamination and damage during experimentation. Interchangeable tips and replaceable tubing allow researchers to perform controlled and cross-contamination-free experiments and to easily upgrade the system to incorporate new capabilities. Each system comes with an SEM-specific seal-checking station, which checks the entire system from port flange to tip before inserting the cell into the microscope's vacuum chamber.



Features

Our SEM liquid holder is compatible with most TEM liquid-cell options. Common options include:

- Continuous Flow
- Dual Flow/Mixing
- Static Cell
- Electrochemistry
- Heating
- Spectroscopy
- Cross-Correlative
- Vapor System

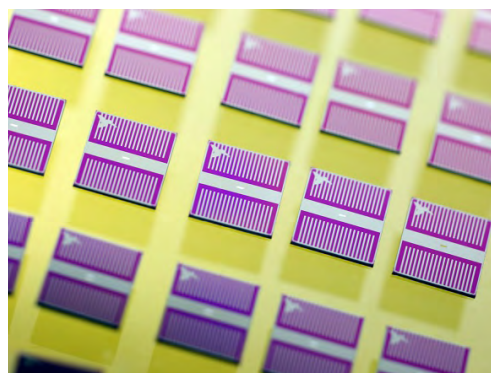


Don't see what you're looking for? We would also be happy to develop a custom solution for you.

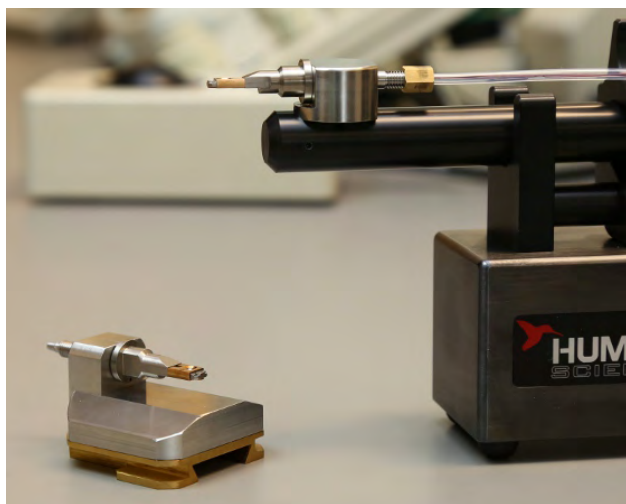
Accessories

Accessories available for your SEM liquid holder include:

- Specialized sample chips
- An SEM-specific version of our seal-checking station



Product Summary



Above: Hummingbird Scientific's SEM liquid holder for JEOL microscopes (left) and FEI microscopes (right, mounted on assembly stand).

Hummingbird Scientific's SEM liquid-cell system allows real-time imaging of solid-liquid interfaces in scanning electron microscopes. The system mount uses the same removable tip design as our liquid TEM holder, allowing for cross-correlative experiments across optical and electron microscope platforms. The two-chip fluid cell allows users to quickly and easily prepare and exchange samples while remaining confident in the cell's seal.

Applications:

- Imaging biological specimens in liquid environments
- Liquid-electrochemistry experiments
- In-situ hydration experiments
- Electrocatalysis
- Electrolysis

Application Example

Cross-Correlative Studies

Researchers studying the interaction of biological structures with the environment have long been hindered by the lack of a single microscopy technique capable of spanning all relevant length scales. In response to this problem, we are working to develop systems that combine two or more imaging techniques.

The SEM liquid holder, for example, enables researchers to perform cross-correlative experiments and to image specimens in the ambient environment. Using the system, researchers at Evergreen State College, Ames Laboratory, and the University of Georgia have successfully taken correlative images of biological specimens using LM, SEM, and TEM.

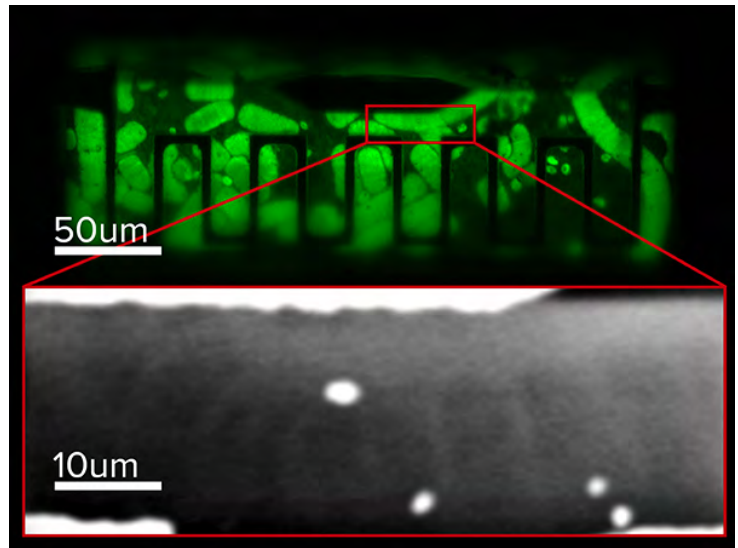


Figure: Correlating fluorescence (top) and SEM images of autofluorescent *Anthrospira* in phosphate-buffered saline (bottom), both taken using Hummingbird's correlative system.

Reference: D.A. Fischer, D.H. Alsem, B. Simon, T. Prozorov and N. Salmon. "Development of an Integrated Platform for Cross-Correlative Imaging of Biological Specimens in Liquid using Light and Electron Microscopies." *Microscopy and Microanalysis* 19: Suppl. 2 (2013) pp. 476-477.

Selected Publications

Reference: D.A. Fischer, D.H. Alsem, B. Simon, T. Prozorov and N. Salmon. "**Development of an Integrated Platform for Cross-Correlative Imaging of Biological Specimens in Liquid using Light and Electron Microscopies.**" *Microscopy and Microanalysis* 19:Suppl. 2 (2013) pp. 476-477.

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