MICROSCOPY TODAY

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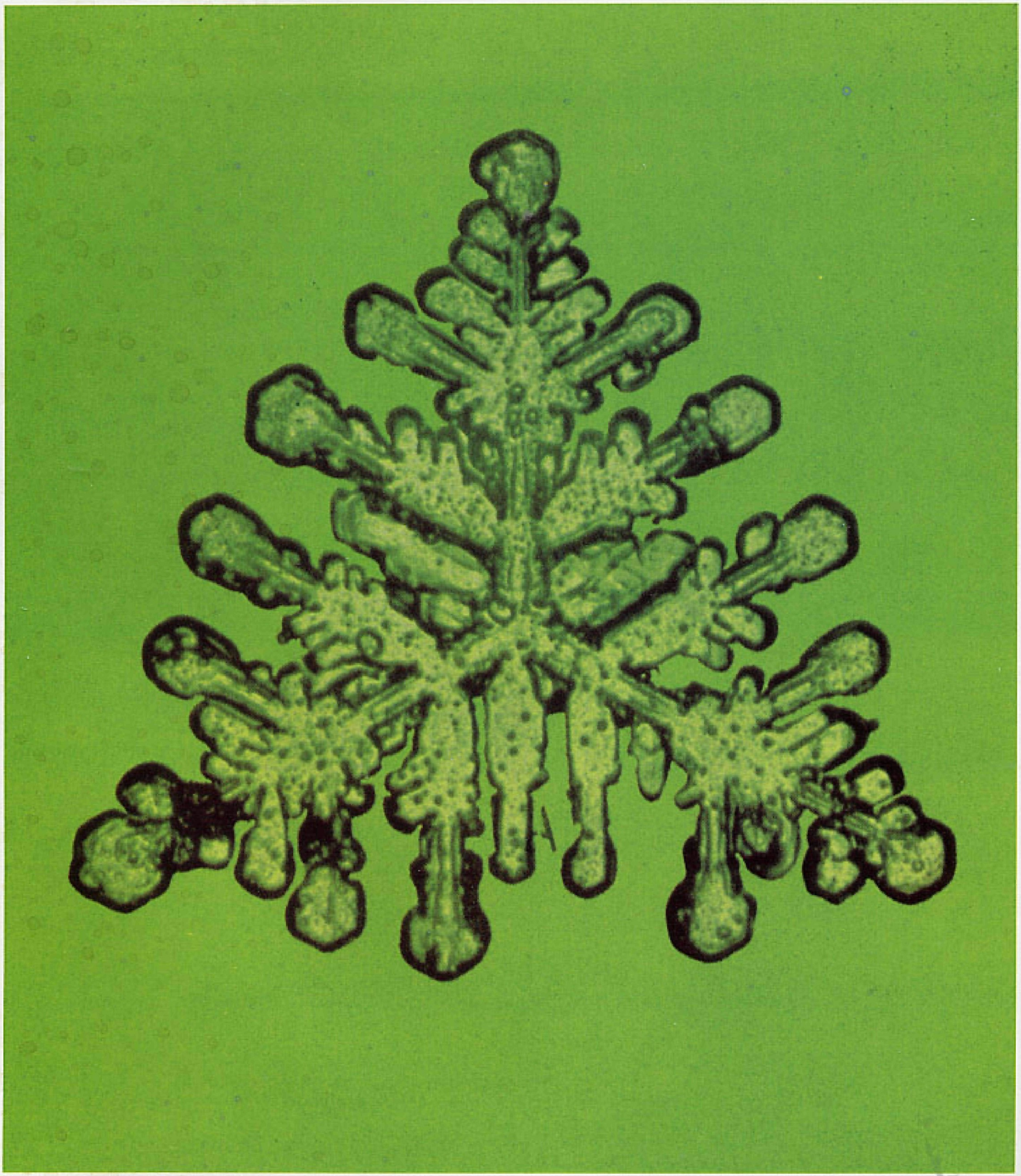
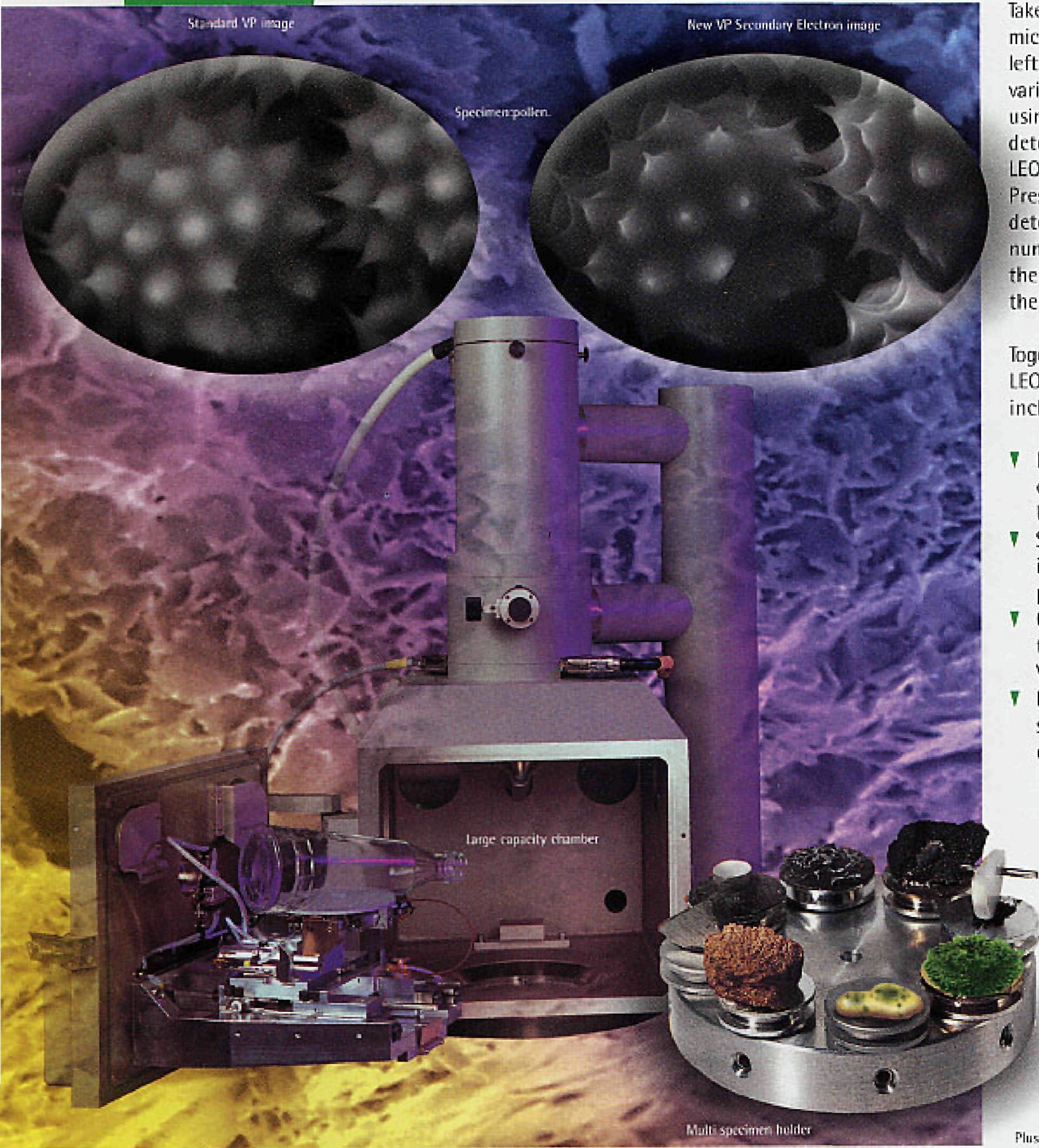


With the New LEO VPSE the difference is clear...



Take a look at the two micrographs of pollen on the left. Both were taken in variable pressure mode, one using a backscattered electron detector, the other using LEO's new VPSE (Variable Pressure Secondary Electron) detector. For low atomic number material such as this, the difference is clear-and so is the image taken with the VPSE!

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The Function of a Water Load in A Laboratory Microwave

Steven E. Slap, Energy Beam Sciences

There are three ways that objects can react to microwave energy within a microwave cavity:

1. They can absorb microwave energy. This is the case with all polar molecules (substances with positive and negative ionic poles). Examples include water, alcohols and biological specimens. Objects which absorb microwave energy will get hot as a result. The total amount of microwave absorbing material within the microwave cavity is called the "load."

2. They can reflect microwaves. This is the case with metals. The function of the metal walls which make up a microwave cavity is to keep the microwave energy within the cavity. The metal walls themselves will not get hot.

3. They can be "microwave-transparent." This is the case with many non-polar molecules, such as paraffin and many plastics. Objects which are microwave transparent will heat very poorly in a microwave.

In processing tissue specimens for electron microscopy or histology, the amount of microwavable material in the cavity can be quite small. That is, it is often the case that a microscopist wants to heat relatively tiny specimens in small volumes of solution (alcohols for dehydration, or a fixative, for example). Such specimens, being polar, will absorb microwave energy very quickly.

The situation is exacerbated when the specimens are in a microwave-transparent solution – an epoxy or acrylic resin or wax, for example. The small specimens will quickly absorb microwave energy while the plastic or wax will absorb very little. This is the primary cause of overheating of specimens for microscopy.

Traditionally, the solution proposed for this problem has been the introduction of a water load, sometimes called a "dummy load," into the microwave cavity. Many published papers recommend putting a small container of 100 -150 ml room temperature water in a back corner of the microwave cavity to absorb "excess" microwave energy. The theory behind this is that the water will absorb enough of the microwave energy so that the specimens will have much less energy left over to absorb and will, therefore, not overheat.

This solution, however, causes new problems. Most laboratory microwaves have been designed to minimize variations of temperature ("hot" and "cold" spots) within the cavity. This is accomplished by means of a microwave stirrer, a carousel, or both. Ideally, there should be little variation in microwave "density" from one spot in the cavity to another. However, when a water load is introduced into the cavity, it attracts the microwave energy, causing the distribution of microwaves within the cavity to become very uneven. This effect can easily be seen through the use of a "neon bulb array." The area around the water load becomes very hot, and the rest of the cavity becomes relatively, but unevenly, cold.

There are two ways around this problem. The first is to use a water load which consists of a tray containing a shallow pool of water which essentially fills the floor of the cavity evenly. This accomplishes the job of the water load to attract microwave energy away from the specimen, without changing the distribution of microwave energy within the cavity. An even better solution is to measure and control the temperature of the solution containing the specimens. Using an accurate thermocouple temperature probe and a temperature controller (similar to a thermostat), the temperature of any solution can be directly monitored and maintained at a level which permits overheating. Another advantage of this method is that it insures consistency and reproducibility, because a series of specimens can be exposed to a specific temperature for a specific period of time. ■

Front Page Image
A Christmas Snowflake

This rather special snowflake, was captured by John Delly of the McCrone Research Institute several years ago. This image, at approximately 50 X, and other aspects of snowflake imaging are reviewed in the article "Stars of Snow" on page 8 of this issue.

MICROSCOPY TODAY

The objective of the publication, perhaps unlike many others, is to present articles and other material of interest and value to the working microscopist. With contributions from our readership, we attempt to cover all aspects of microscopy. The publication is mailed, ten times a year, at no charge to some 8,000 microscopists in the United States - all of which have requested subscriptions. Due to the current relatively low number of international readers, and resulting very high postage costs, we are forced to charge the following for international subscriptions (10 issues/year):

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