The Electros ETEM 101

Designed by Gertrude Remper

The possibility of both magnetic and electrostatic electron lenses was first realized by Kossel in 1906. In the 1930s, electron microscopes with magnetic lenses were being developed by Pauls and colleagues at the Technical University in Berlin, both in Berlin, under Bloch, and in Cologne under Zernike. An electron microscope with electrostatic lenses was constructed by O. Busch, in 1926. In the 1930s, electron microscopes with both magnetic and electrostatic lenses were also built by G. Trüb and at the Siemens company, both in Berlin. In the 1940s, the magnetic lenses had a focal length of 2000 mm, while the electrostatic lenses had a focal length of 500 mm. The development of high-resolution electron microscopes was based on a combination of magnetic lenses and electrostatic lenses.

Electrostatic TEM

The Electrostatic Transmission Electron Microscope (ETEM) is a type of electron microscope that uses electrostatic lenses to form an image. This type of microscope is particularly useful for imaging biological samples, as it does not require the use of heavy metal ions, which can damage delicate structures.

Remper’s Involvement with earlier electrostatic TEMs

Remper then moved to the Elektros company, a Tektronics spin-off company, in 1970, in Tigard, OR. The company President was Jon Orloff, who later recounted some of its history, and Arnold Frisch, who completely redesigned the electronics from the Tektronics Mikros TEM produced before Elektros closed its doors in 1973.

Comparison between magnetic and electrostatic lenses

Electrostatic lenses are self-shielding because there are no magnetic polepieces, which have a magnetic field outside the lens. This also means that the specimen is not in a magnetic field. Because there is no leakage of magnetic field between lenses, it is not necessary to align the lenses when changing acceleration voltage or changing focus.

The ETEM 101 is based on a modified column shown here, which is nearly identical to a high-resolution electron microscope.

Method for real-time stereo

In 1949 while working at Farrand, Remper improved the shuttle-type stereoscope, each eye seeing only the image from one tilt direction. This was accomplished by placing an intermediate lens that shifted the beam, which was on an electrostatic lens, above the objective lens. Invertion of the intermediate lens was used to produce real-time stereo images. This TEM was deployed at M&M in 2003. An advertising brochure is shown here. About 40 ETEM 101s may have been constructed, but not all were sold. At least 10 survive and three or four are still operational.

Marketing the Elektros ETEM 101

The ETEM 101 is marketed as a research tool suitable for commercial research. It is a high-resolution TEM with a resolution of 1.2 Å, even at 40 kV, providing perfectly satisfactory results. This was true not only for the ETEM 101, but also for the ETEM 105, a comparison between the ETEM 101 and a commercial transmission electron microscope.

A sample micrograph from an ETEM 101

The image of a fish gill from the Elpoch paper shown on the right was taken by the ETEM 101. The ETEM 101 was used to observe the gill filaments, which were about 700 μm in length. Although ETEM 101s were deployed at M&M in 2000, an advertising brochure is shown here. About 40 ETEM 101s may have been constructed, but not all were sold. At least 10 survive and three or four are still operational.

ETEM 101 column

The ETEM 101 column is a modification of a conventional column, but is nearly identical. The lenses are not made with water cooling, and are cooled by diffusion pumps and, in some cases, electronic charge-cooling. The lenses are not made with water cooling, and are cooled by diffusion pumps and, in some cases, electronic charge-cooling. The lenses are not made with water cooling, and are cooled by diffusion pumps and, in some cases, electronic charge-cooling.