Cathodoluminesence Attachment for the JEOL 733 Electron Microprobe

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Introduction

The Cathodoluminescence Attachment is a tubular adaptor with one threaded end and two mounting flanges at the other, arranged so that the photomultiplier of the Secondary Electron detector can be either mounted in place of the optical microscope or mounted in place of the substage illuminator.

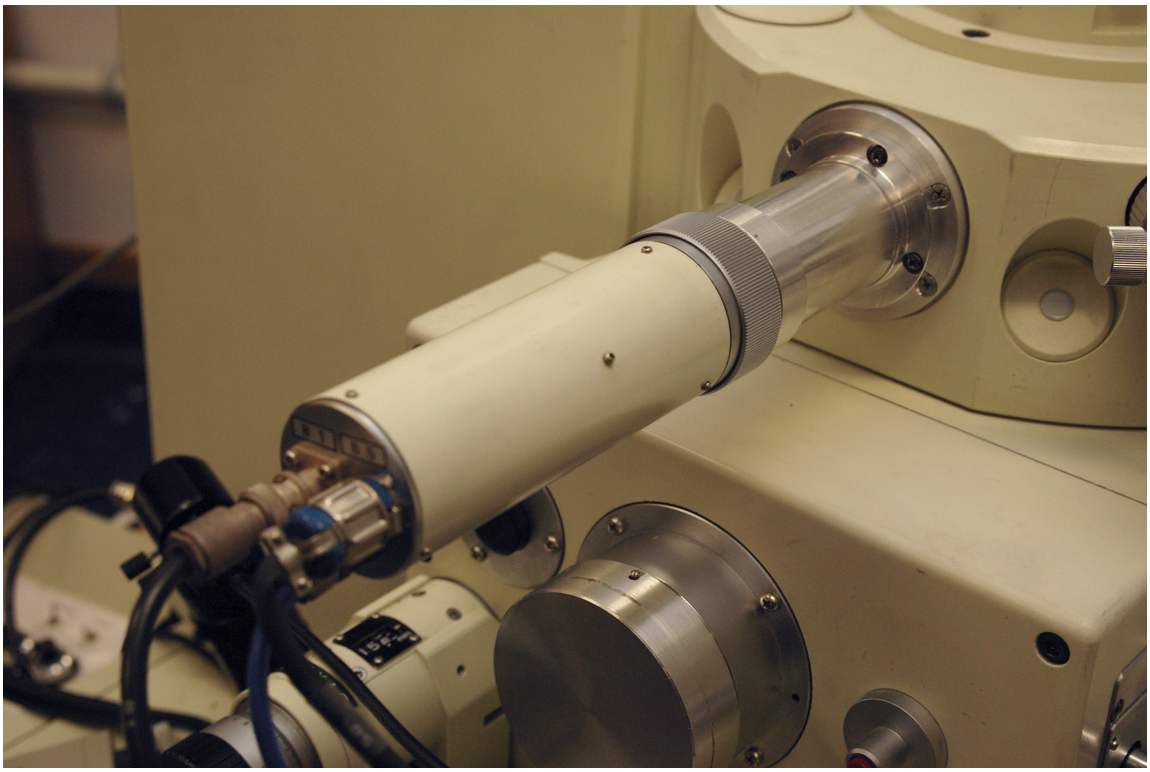
In either position light emitted from the sample can be measured. If the electron beam scans a sample a cathodoluminescence image can be built up.

When mounted in place of the optical microscope both petrographic slides and block mounts can be viewed. A dual base flange is used to adapt the fitting to the electron microprobe. The field of view is restricted somewhat by the optical system.

When mounted in place of the substage illuminator only petrographic slides can be viewed as this position receives light transmitted through the slide. A wide field of view is available.

Optical Microscope Position

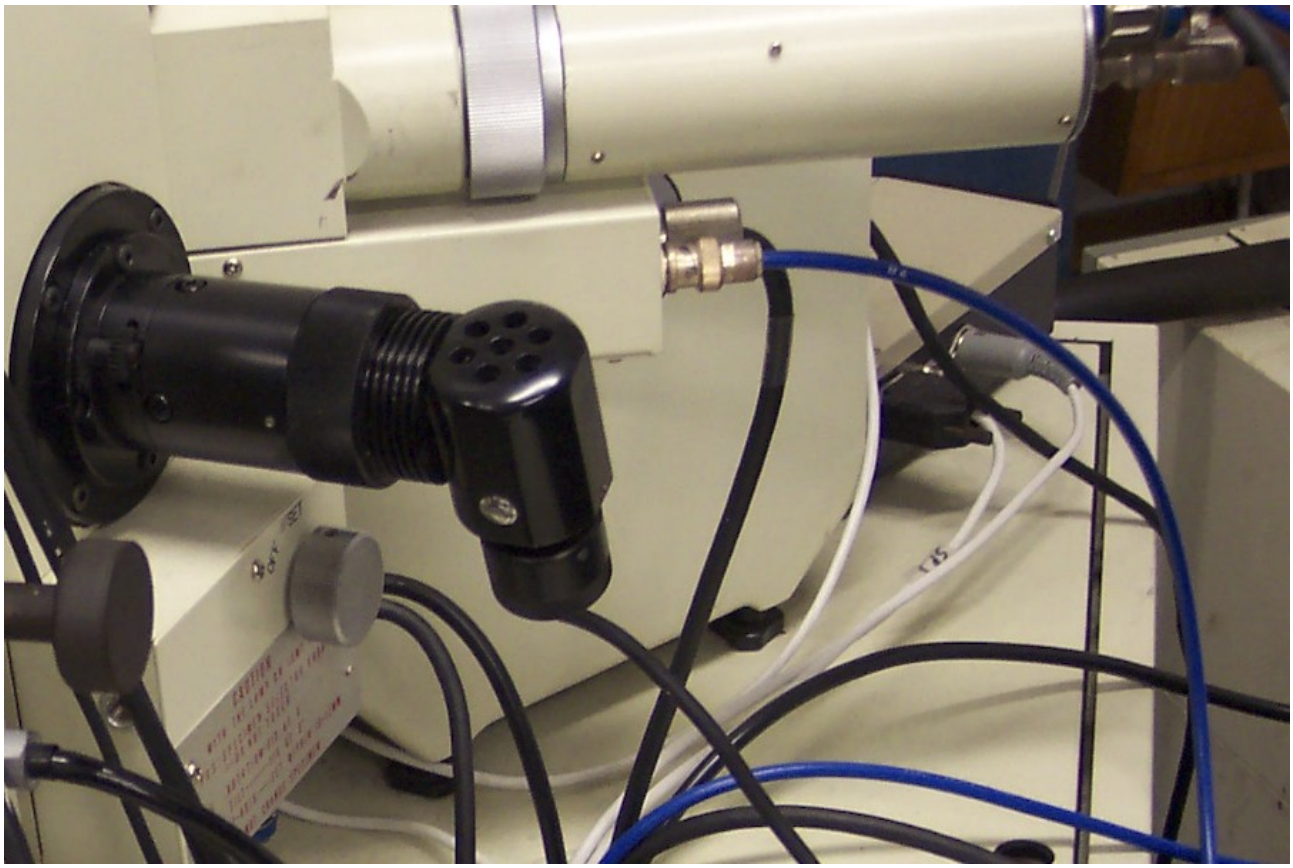
Mount the larger flange on to the microprobe in place of the optical microscope, then mount the Cathodoluminescence Attachment onto it. Since the camera is removed the backscattered electron image is used to find the sample and to get the best focus. The light transmitted through the electron microprobe optics comes out below the axis of the photomultiplier. A short thick perspex light pipe is used to correct this offset.



The perspex light pipe can drop out of position when fitting, reducing the light collected. Fit the light pipe loosely in the adaptor using plastic centring disk. Engage the other end into the optical window recess in the electron microprobe and push the adaptor forward so it can be mounted.

Substage Illuminator Position.

When the photomultiplier is mounted in place of the substage illuminator only petrographic slides can be viewed. The substage mirror needs to be swung into place after the sample is rotated into place. A wider field of view can be observed with this mounting. The light pipe and the larger diameter base flange is not used. Another advantage of this position is that the camera is available for focussing. Note that the illumination is interlocked with the photomultiplier voltage and you won't see anything with the microscope camera until the photomultipler voltage is turned off.



In the photo the Substage light is in it's normal position as is the photomultiplier behind it. To move the photomultipler unscrew the knurled mounting collar. Note that in the secondary electron detector position the mounting is spring loaded so you will have to push a little to get the thread started. Take care to protect the glass end of the photomultiplier. Check for a locating pin when you restore it to it's original position. Unscrew the substage light and use the Cathodoluminescence Attachment, without the additional flange, to mount the photomultiplier in it's new position.

The control below the illuminator swings the substage mirror into position below the sample. Make sure the sample is in position before moving. If it is moved, rotation will be disabled. The computer reference will change however. Repeating the mistake twice will restore the proper reference.

Note: After the photomultiplier has been moved you should cover the exposed secondary electron detector port. Stray room light getting inside produces horizontal bars on the image.

Operation

When the secondary electron photomultiplier is moved make sure that it is not energised. It is very sensitive to light. If any stray light problems are observed darken the room and cover the base of the microscope column, at the back, with a cloth. Light gets in here and it may be seen by the photomultiplier.

Once the sample is in position lower the room lights and proceed as though you are viewing secondary electron multiplier images.
To view an image, energise the beam. Set up for secondary electron viewing. Use the PMT ON switch on the **SECONDARY ELECTRON IMAGE** panel to energise the photomultiplier.

Use the **BRIGHTNESS** and **CONTRAST** controls on the **SECONDARY ELECTRON IMAGE** panel to obtain an image. The **CONTRAST** control changes the voltage applied to the photomultiplier. It therefore acts as a sensitivity control. Effectively it sets the white levels. The **BRIGHTNESS** control adjusts a DC voltage which is subtracted from the CL signal. Its role is to set the black levels. An ideal image has no part fully black nor fully white. Sometimes the black levels are raised further so detail can be more easily seen. The white levels may be lowered for the same reason. Images for CL will always be a bit soft because the volume emitting light is larger than that energised by just the electrons.

If there is no CL then you won't see much, only a faint luminescence from the epoxy. Often strong CL is observed and the contrast control will need to be turned down. The brightness may need adjusting as well. Try to get a good range of tones, ranging from nearly black to nearly white. Save images in the usual way.