Principle & use of the Leica SP1600 saw microtome

Slices of very hard materials can be prepared without destroying the morphology of the specimens for the use in light microscopical investigation and section thicknesses of approximately 30 microns can be achieved under optimal conditions. Most objects (such as resin embedded undecalcified bone or teeth) need a thickness of 80-100 µm for best results. The Leica SP1600 is very often used as a pre-preparation instrument for the Leica SM2500 with Leica SP2600 (Polycut with Ultramiller).

With the saw microtome, slices of about 100-500 microns thickness are prepared and finished to a thickness of about 20-30 microns for the investigation with the transmission light microscope using the Leica SP2600. (Limitation of the Leica SP2600: no titanium, steel or ceramic material should be used). The Leica SP1600’s operating principle is based on a specimen holder which is guided extremely slowly against the rotating cutting edge of the diamond coated inner-hole saw blade.

This preserves the morphology of the sample and offers ideal conditions for microscopic evaluation. The speed of the specimen advance can be controlled by a hydraulic drive. A higher or lower speed can be selected depending on the material to be sliced. A built-in water cooling device prevents overheating of the sample, removes saw dust from the cutting edge and thus prolongs the life time of the saw blade.
Specimen advance:

The heart of the microtome is a diamond-coated inner-hole saw blade. An annular frame makes it stable although it is only 260 microns thick. To prepare a section, the object holder is guided slowly against the rotating cutting edge of the saw blade. The speed of the object holder can be adjusted according to the specimen conditions. Compared to the sectioning principle, the sawing method causes less compression.

With the sectioning technique serial sections can be produced, as opposed to the sawing technique in which the user has to calculate the loss of material caused by the thickness of the diamond coated saw blade. The speed of the rotating blade is approximately 600 rpm. The built-in water cooling device prevents overheating of the object and removes saw dust from the cutting edge and thus prolongs the lift time of the saw blade. The section thickness is set manually with a knurled screw on the object arm.

Specimen Preparation:

The object arm can be mounted into the object holder. The height of the object has to be adjusted until the surface of the object is slightly above the upper edge of the saw blade. The surface of the block has to be trimmed. Trimming means, that a plane surface has to be cut prior to produce slices of a defined thickness.

During the sawing process, the water flow has to be adjusted so that the water jet lands on the edge of the saw blade. The most favourable feed rate must be determined for each individual object.

As a general rule, however, the following applies: the lower the speed, the less forces coming to bear on object and saw blade, i.e. the gentler the sawing process will be. After trimming, the first undefined slice can be removed from the saw blade. Now the desired section thickness can be selected, considering the thickness of the saw blade has to be added to the desired thickness of final section.

For example: if the saw blade has a thickness of 280 microns and the final section should have a thickness of 120 microns a feed of 400 microns has to be selected on the knurled screw for the setting of the section thickness.

The section can be prepared and finally removed from the saw blade. For the preparation of very thin sections of about 20-30 microns thickness, it is recommended to stabilize the section during the sawing process. To do so, a glass cover slip can be glued onto the trimmed surface of the specimen block using cyanoacrylate glue.