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Goren Microscope

Portable polarizing microscope

Instructions Manual

Introduction

This new microscope design will enable research-grade analysis outside the laboratory. Developed after years of applied research, and tests of nearly every available field microscope, it was devised to be portable, but still ergonomically convenient and not too small to allow convenient operation. As opposed to most other field microscopes it complies with modern standards, being binocular and having modern high quality optics. Still, it is self-sustained with the special LED illumination supplying bright white light and over 20 hours of work on the three AAA batteries. It is also highly versatile to allow different applications such as polarization and phase contrast. Last, it is very reasonably priced for what it offers, as opposed to any past effective field microscope.
Polarizing microscopes are used in the study of thin sections of minerals and rocks as well as other unisotropic materials (fibers, plastics, etc.). The optical system is similar to that of other modern compound microscopes but it is equipped with additional appliances. The most distinctive features are the polarizer and analyzer, rotatable stage and accessory filters. This special equipment allows the evaluation of properties and characteristics of materials that cannot be measured by other microscopical methods.

1. Nomenclature and construction

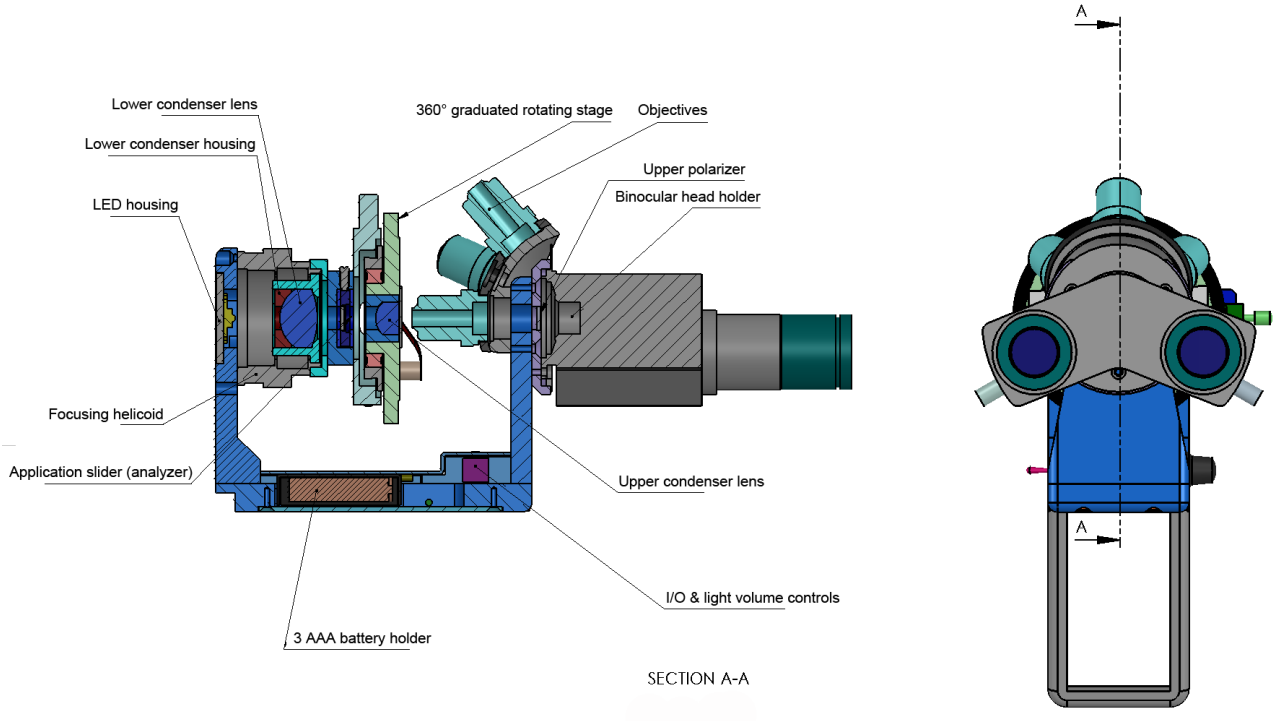

Figure 1: Cross-section of the Goren polarizing microscope

2. Technical specifications:

Eyepiece 10× WF 20.
Eyepiece grid: Crosshair micrometer graduated eyepiece (standard configuration).
Objectives - standard
4×, NA0.08, working distance (w.d.) 16 mm;
10×, NA0.25, w.d. 3.6 mm;
40×, NA0.60, w.d. 0.6 mm.
Optional objectives 20×, 60×, 100× Oil.
Condenser Original Abbe condenser within the patented substage helicoid system.

Polarizer+Analyzer: Standard configuration.
Optional Compensators: 1/4λ, λ (factory assembled on the analyzer slider).
Mechanical Stage: Round rotating 360^0 graduated stage with slide clips.
Illumination LED 3W.
Power supply 3 x AAA batteries. Optional: USB power supply or 110v/240v mains (factory assembled).
Dimensions WxDxH 140x170x300 mm.
Weight ~1.7 Kg
Carrying Case Optional.

3. Setting up the instrument

Figure 2: Battery housing cover

Before using the microscope, it should be unpacked and prepared for first use. Remove it from the packing and place it on a stable surface. Remove any remains of the cardboard, Styrofoam or tape from the pack.
With a small Phillips screwdriver carefully open the battery housing cover at the back of the microscope (Fig. 2, marked by arrows) and place three AAA batteries according to the directions drawn in the housing. Rechargeable batteries can be used, but the microscope is not equipped for charging, which should be made in a normal charger. Fully charged batteries will suffice for approx.15-22 hours of work depending on brand, light volume and climatic conditions.

4. Operational instructions

4.1 Focusing

Focusing is carried out with the helicoid ring under the microscope stage. The helicoid is sensitive enough to allow fine focusing at any magnification.

4.2 Interpupillary distance and diopter adjustments

Every human eye is different, so only the adjustment of the eyepieces will bring the microscope to its best performance.

- Before adjusting the interpupillary distance, adjust the right eyepiece to see clearly the crosshair and the graduated micrometer ruler by turning the upper ring of the right eyepiece.
- Adjust the interpupillary distance so that both the right and the left field of view becomes one by folding the binocular head until an overlapping circle is seen by both eyes.
- Change to 10x objective and bring a specimen into focus looking through the right eyepiece. Shutting your left eye, focus the right eyepiece by turning the helicoid ring till sharp image is obtained.
- When the best focus position is reached in the right eyepiece, close your right eye and use the left eye to correct the focusing of this eyepiece using only the diopter ring. Sharp image should appear now in both eyepieces.
- Change to a higher magnification to verify the result and if necessary, repeat the procedure. Higher magnification objectives do have a smaller depth of focus, so the adjustment will be more precise.
- The diopter position for each user can be read from the scale near the diopter ring, so it can be easily reset.

This adjustment will enable the user to observe the specimen with both eyes.

4.3 Centering the stage

Please refer to Fig. 3 for details:

- Set a specimen on the stage with the cover glass facing up and the analyzer in an out position (namely in plane polarized light).
- Turn on the light and bring the specimen image into focus, using the 4× objective.
- Choose a point in the slide and bring it to the center of the crosshair (Fig. 3: A).
- Rotate the stage counter-clockwise till the point will be found in the "two hour" position (Fig. 3: B).

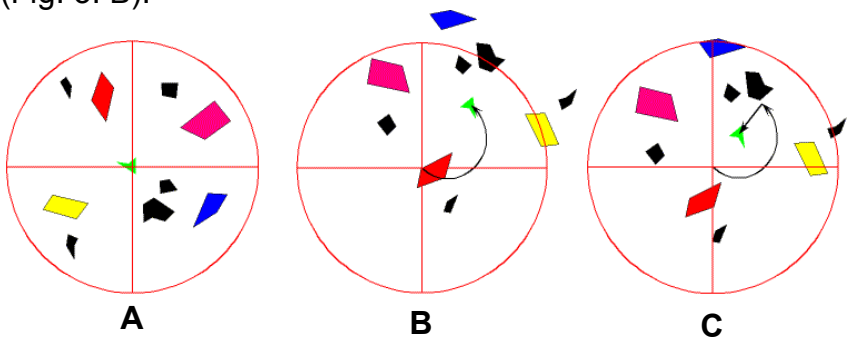

Figure 3: Principle of stage centering

- By turning the two milled knobs controlling the stage, move the point till it is found halfway between its previous location and the center of the crosshair (Fig. 3: C).
- Switch to the 10× objective.
- Repeat the above action till the chosen point remains in the center of the crosshair when the stage is rotated.

4.4 Operating the polarizer and compensators

- Focus on the specimen.
- Bring the analyzer into the optical path by pulling out the substage slider.
- If a compensator (wavelength plate, see next section) is installed, pulling the substage slider further out will position the compensator in the optical path.

4.5 Compensators

Polarizing microscopes may be equipped with retardation compensators in the optical beam path between the polarizer and the analyzer.
Compensators are sections of optically anisotropic material which, when inserted in the microscope between crossed polarizers, produce a defined optical path difference of mutually perpendicular plane- polarized light waves.
A. ¼λ-plate- the ¼λ-plate (also called mica plate) has an optical path difference around 140nm.
B. 1λ-plate (also called tint plate, gypsum plate, or first order red): the 1λ-plate is made to give 1λ optical path difference for green light of 550nm. This wavelength is therefore extinguishing with the resulting interference color having the typical tint of the first-order magenta red/violet.

4.6 Measuring retardation from 1λ to 4λ:

Observing extinction position
Observe the position where the part of the specimen to be measured becomes darkest by rotating the stage under crossed polarizers.
Observing Subtraction position
Rotate the stage 45 degrees to the diagonal position: here the specimen appears to

be at its brightest. Insert the appropriate compensator into the slot: verify the interference color of the part to be measured. Rotate the stage another 90^0 to get the associated color. With those two observed colors, the +/- position of the sample can be determined.

4.7 Obtaining an interference figure

This microscope is not equipped with a Bertrand-Amici lens. Because the condenser is constantly found in a conoscopic position, interference figures can be seen if the 40× objective is placed in the optical path and the left eyepiece is removed. The interference figure can be seen in the crossed polarizers position inside the eyepiece tube.

Please note: The eyepieces is secured in place by a small socket set screw. Be careful not to lose it when allowing the left eyepiece to be pulled out.

5. Care and maintenance

General care instructions.

- Avoid placing the instrument in locations exposed to direct sunlight, dust, vibration, high temperature, and high humidity.
- Operating environment: Altitude: max 2000 meters. Ambient temperature: 15^0-35^0C.
- Avoid frost, dew, percolating water, and rain.
- The microscope may be placed on a table, shelf, bench, or even a flat rock in the open. It can be placed in an upright position or tilted by opening the folding foot to ease operation

Do not disassemble.

- Disassembly may affect significantly the performance of the instrument and will void the terms of the warranty.
- Never attempt to dismantle any parts other than described in this manual. If you notice any malfunction, contact MRC representative.

Cleaning the microscope

- Do not use organic solvents such as ether, alcohol or paint thinner. Doing so could result discoloration of painted or plastic surfaces and damage to the optics.
- When cleaning lenses do not use any solvents other than absolute alcohols as they may damage lens bonding cement.
- For stubborn dirt, dampen a piece of gauze with diluted neutral detergent and wipe lightly. Optical parts should be cleaned with lens tissues only.

When not in use

- When not in use, turn off the instrument and cover it with dustcover. Store in a place low in humidity where mold is not likely to form.
- Store the objectives, eyepieces and filters in a container or desiccator with drying agent.
- Proper handling of the microscope will ensure years of trouble-free service.
- If repair becomes necessary, please contact MRC agency or Technical Service.

Note:

If the equipment is used in a manner not specified by the manufacturer, the protection provided by the manufacturer may be expired.