

## Grinding and polishing of apatite fission-track mounts

### Grinding:

- To expose internal apatite crystal surfaces, the mounts need to be grinded. Grinding papers # 800, 1200, and 2500 are available for this. Be particularly careful with the 800 paper, it grinds the mount quickly and you may lose grains completely when you grind for too long! When grains are already close to the surface, you may skip the # 800 paper and start with the # 1200 paper.
- Put some VE water on the paper and grind the mount in circles. Rotate the mount now and then to distribute the force put on the mount equally.
- Check the surface of the mount under the microscope often to not lose the grains. The aim is to expose as many apatite internal surfaces as possible.
- When done with the # 800 paper, clean the mounts in an ultrasound bath, then continue with the # 1200 paper and eventually the # 2500 paper. Clean the mounts between every paper and afterwards.



*Grinding mount in circles with some water on the grinding paper. The mount needs to be checked under the microscope often to make sure that the apatites do not fall out. Remember that you use 2 or 3 different grinding papers, so rather grind less with a coarser paper and finish the grinding on a finer paper. Photo: E. Enkelmann.*

### Polishing:

- The mounts need to be polished to produce clear and even surfaces. A polishing machine and 6, 3, and 1  $\mu\text{m}$  diamond polishing suspensions are available for this.
- Make sure that the mounts are cleaned in an ultrasound bath after the last grinding step. Similarly, finish all mounts with one polishing suspension size before continuing with the next finer one. Always clean the mounts in an ultrasound bath before continuing with a finer polishing suspension.
- Make sure the machine and all used parts, and to some extent the room is clean. Open pressured air pipe and switch on the polishing machine (switch on the back, left). Take off the lid and place the first pad on the polishing wheel. There are pads assigned to specific polishing suspension sizes, i.e., there is a pad labeled on the back with "6  $\mu\text{m}$ ". Use this pad and the Tegra Doser with 6  $\mu\text{m}$  suspension.
- Use the settings for "Einzelprobenpräparation" (single sample preparation). The settings last used are saved and show on the display (You can use: UpM

Scheibe/Halter 120/60; Zeit 8m00s; Kraft/Richtung 10N/'opposite direction'; Wasser Aus; Doser Nr./Niveau 1/10).

- Place the sample holder over the pad and press the yellow button to lower it onto the pad. Make sure it is placed on the side of the pad and neither overlaps with the rim or the center of the pad (see pictures below). Place the mounts in the sample holder with the grains-side on the pad. The green button starts the machine.
- The polishing works best when it is as dry as possible. The automated polishing suspension supply may leave it too wet. Therefore, add drops of suspension manually with the orange button below the yellow one when you see/hear the pad becomes to dry. Add several drops when starting the polishing and then add 1-2 drops every ~2 minutes or when it becomes too dry. The pad looks a bit shiny and there will be no ring of suspension around the center of the pad under ideal conditions. After a while you will be able to also hear what the sound of the polishing process should be, i.e., you will hear if it is too wet or too dry.
- You can start by polishing for 8 minutes, then (after rinsing off remaining suspension of mount under water and drying it) check under the microscope whether this was enough or whether you need to polish again with the same polishing suspension. The rims of the grains look black and frayed under the microscope when not polished sufficiently. The aim is to have those narrow and even. However, grains can still be lost from the mount during polishing and you must be careful not to polish for too long.
- After all mounts are polished with one suspension size, clean the mounts in an ultrasound bath. Take the polishing pad off and let it dry outside its drawer. Clean the sample holder and polishing wheel before using the pad for the next finer polishing suspension (3 or 1  $\mu\text{m}$ ).
- Repeat procedure for the different suspension sizes. Depending on the samples, it is possible to skip the 3  $\mu\text{m}$  suspension and move on to the 1  $\mu\text{m}$  suspension.
- Clean samples and polishing machine (especially the sample holder) properly after you finished.



*Left and middle: Polishing machine with sample holder for 6 mounts. The different pads for different polishing suspension sizes stick magnetically to the polishing wheel. The pads are kept in the drawers beneath the machine. Right: Microscope to check the polishing progress. Photos: E. Enkelmann.*