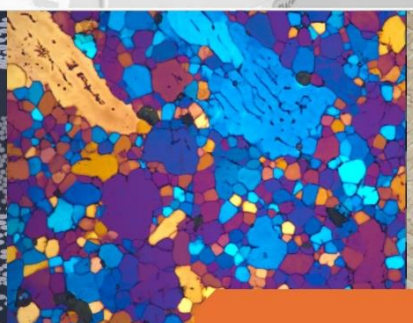
QATM
QUALITY ASSURED

Application lab. report

Preparation of various steel alloys on Qpol 300 Bot

QATM-Preparation method

Objective:

The samples should be prepared once with a combination of Qgrind XL + Qpol 250 Bot and once with Qpol 300 Bot. The samples are different steel alloys such as 1,7139, 9170, 34MnB5, 42CrMo, with various heat treatments like hardening, tempering and carburizing. This report compares the preparation with and without mounting the samples. It also presents a juxtaposition of the preparation time using the Qpol 300 Bot or Qgrind XL plus Qpol 250 Bot.

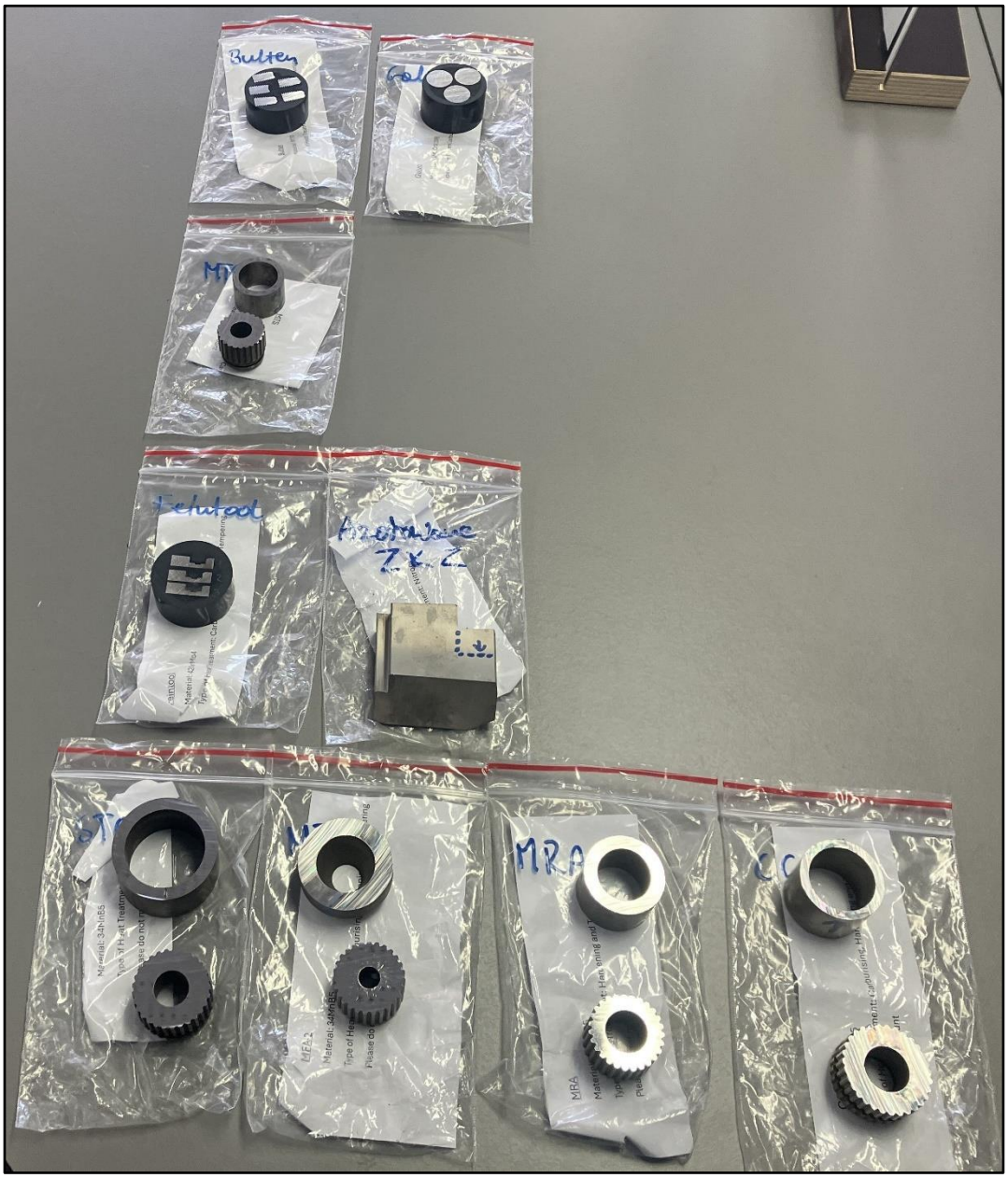


Figure 1: The samples in as-received condition.

QATM-Preparation method

Hot mounting

Mounting					
Device	Consumable	Heating time	Temperature	Pressure	Cooling time
QPRESS 50	EPO-Black	6:30 min.	180°C	235 Bar	4:00 min.
Filler or additional consumables	Heating power	Pressure mode	Cooling power		
-	100%	From beginning	100%		
Notes					
The samples can also be easily mounted using KEM 20 and cold mounting methods.					

QATM-Preparation method

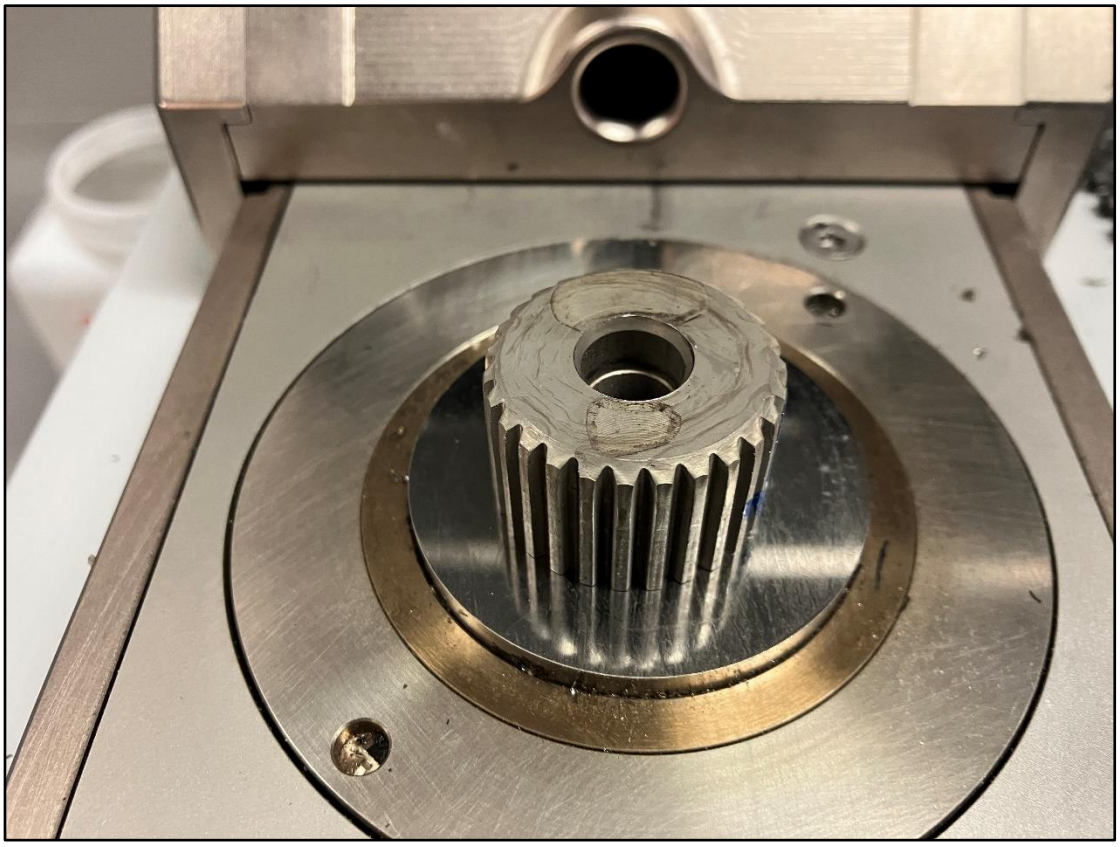


Figure 2: The sample in the QPRESS 50 hot mounting device.

Figure 3: The mounted samples.

QATM-Preparation method

Grinding/Polishing

Device	Sample holder	Pressure mode
QGRIND XL + QPOL 250 Bot **or** QPOL 300 Bot	Z5803200 6 × ø 40 mm Drop shape	Central

Step		MEDIUM		RPM		N	min
	Planar grinding	Al_2O_3-Stone P100	H_2O	1500	120 ◄ ►	150 N	1 mm removal rate 3:00 Minuten
Cleaning: Water: -- s	Compressed air: -- s	Ethanol: 15 s	Compressed air : 20 s				
Drying: 15 s	Rotating speed of the samples holder: 100 rpm						
	Pre-Polishing	Contero H	Dia Suspension Wb. Poly, 9µm + alc. Lubricant	150	120 ►►	150 N	7:00
Cleaning: Water: -- s	Compressed air: -- s	Ethanol: 15 s	Compressed air : 20 s				
Ultrasonic bath:30 s							
Cleaning: Water: -- s	Compressed air: -- s	Ethanol: 15 s	Compressed air : 20 s				
Drying: 15 s	Rotating speed of the samples holder: 100 rpm						
	Polishing	Gamma	Dia Suspension Wb. Poly, 3µm + alc. Lubricant	150	120 ►►	150 N	5:00
Cleaning: Water: 15 s	Compressed air: -- s	Ethanol: 15 s	Compressed air : 15 s				
Drying: 15 s	Rotating speed of the samples holder: 100 rpm						
	Polishing	Zeta	Dia Suspension Wb. Poly, 1µm + alc. Lubricant	150	120 ►►	140 N	3:00
Cleaning: Water: -- s	Compressed air: -- s	Ethanol: 15 s	Compressed air : 15 s				
Drying: 15 s	Rotating speed of the samples holder: 100 rpm						

	Etching (chem.)	Nitric acid 3 % (alcohol base)		0:03

Notes

- Pre-dosing for 9 µm, 3 µm und 1 µm: 3 s
  Dosing interval and dosing duration for Dia. Suspension 9 µm, 3µm, 1µm:
  Every 30 s for 1,3 s
- Dosing interval and dosing duration for lubricant:
  Every 60 s for 1,3 s

QATM-Preparation method

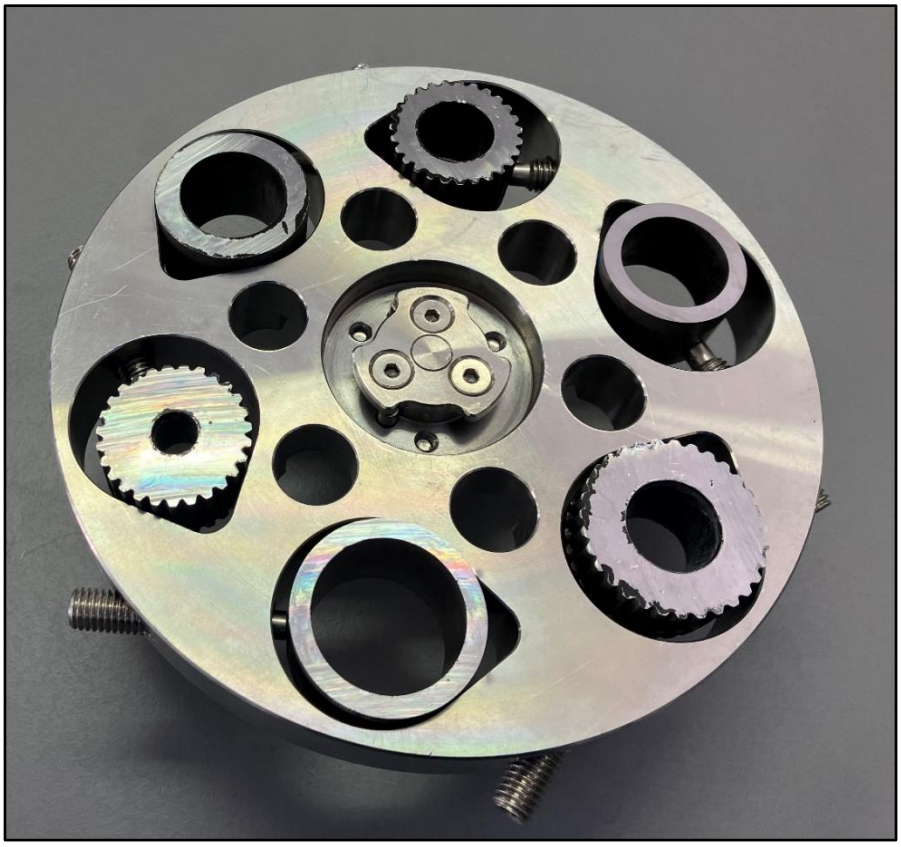


Figure 4: The unmounted samples fixed in the sample holder.

Figure 5: The samples in the sample holder after preparation.

QATM-Preparation method

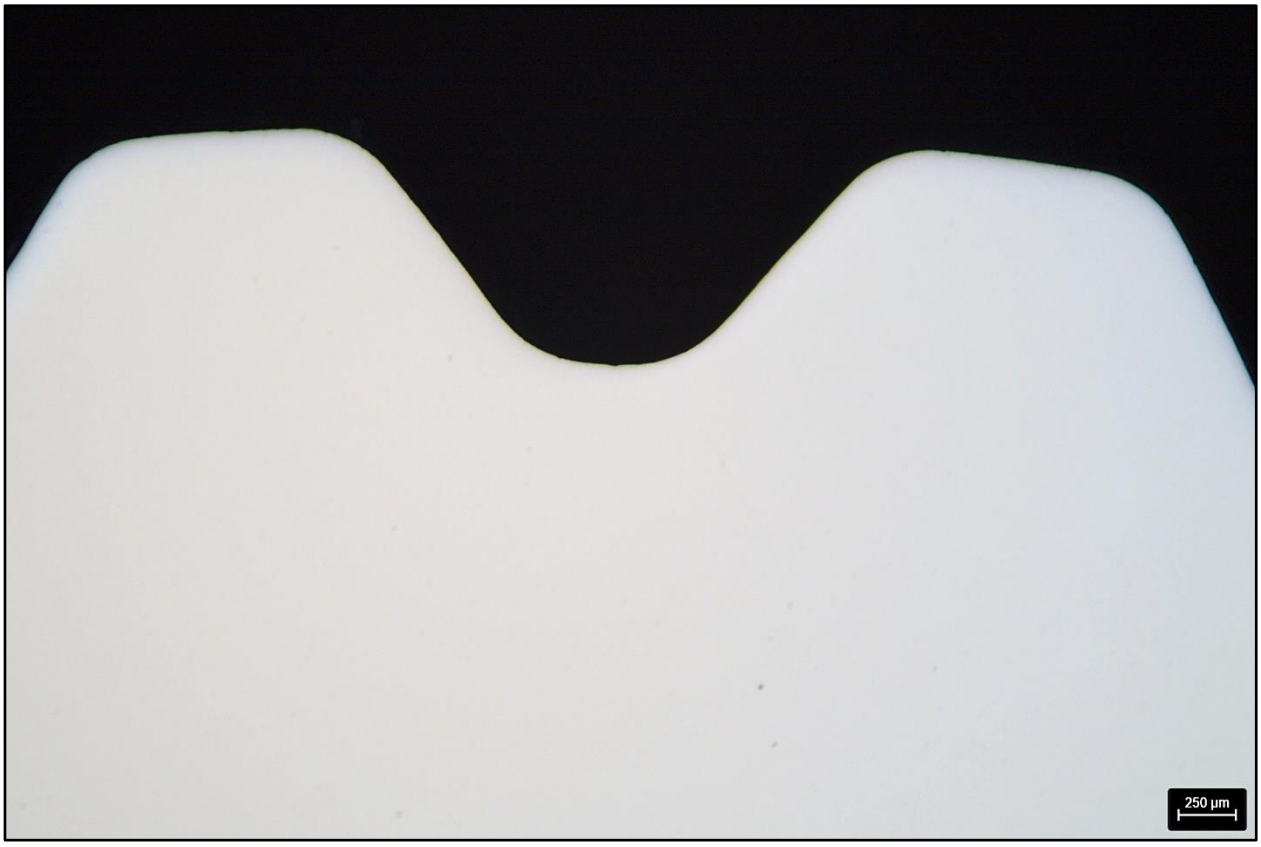


Figure 6: The edge zone of the gear wheel samples "cc" before etching – 25 x.

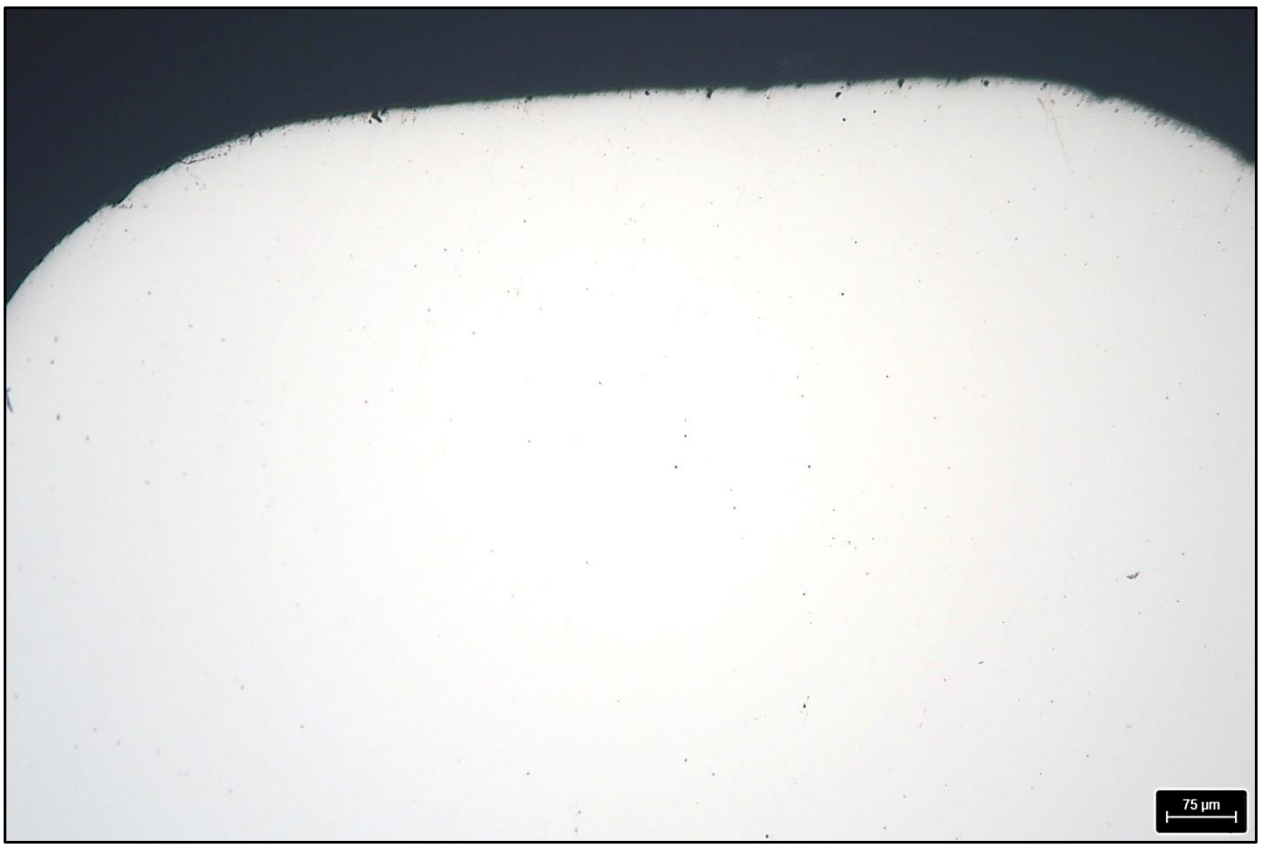


Figure 7: The same region as figure 6 with higher magnification – 100 x.

QATM-Preparation method

Figure 8: The same region as figure 6 with higher magnification – 100 x.

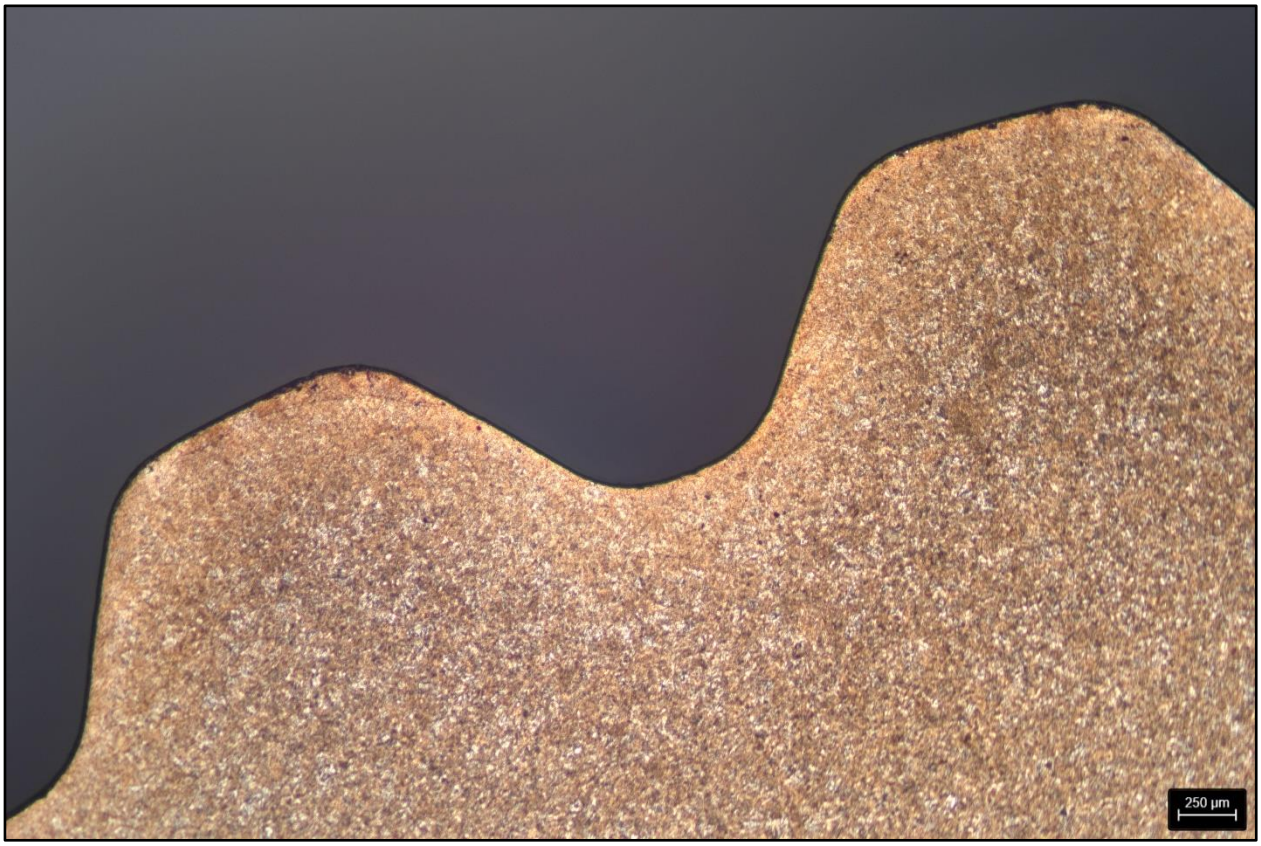


Figure 9: Sample "cc" after etching – 25 x.

QATM-Preparation method

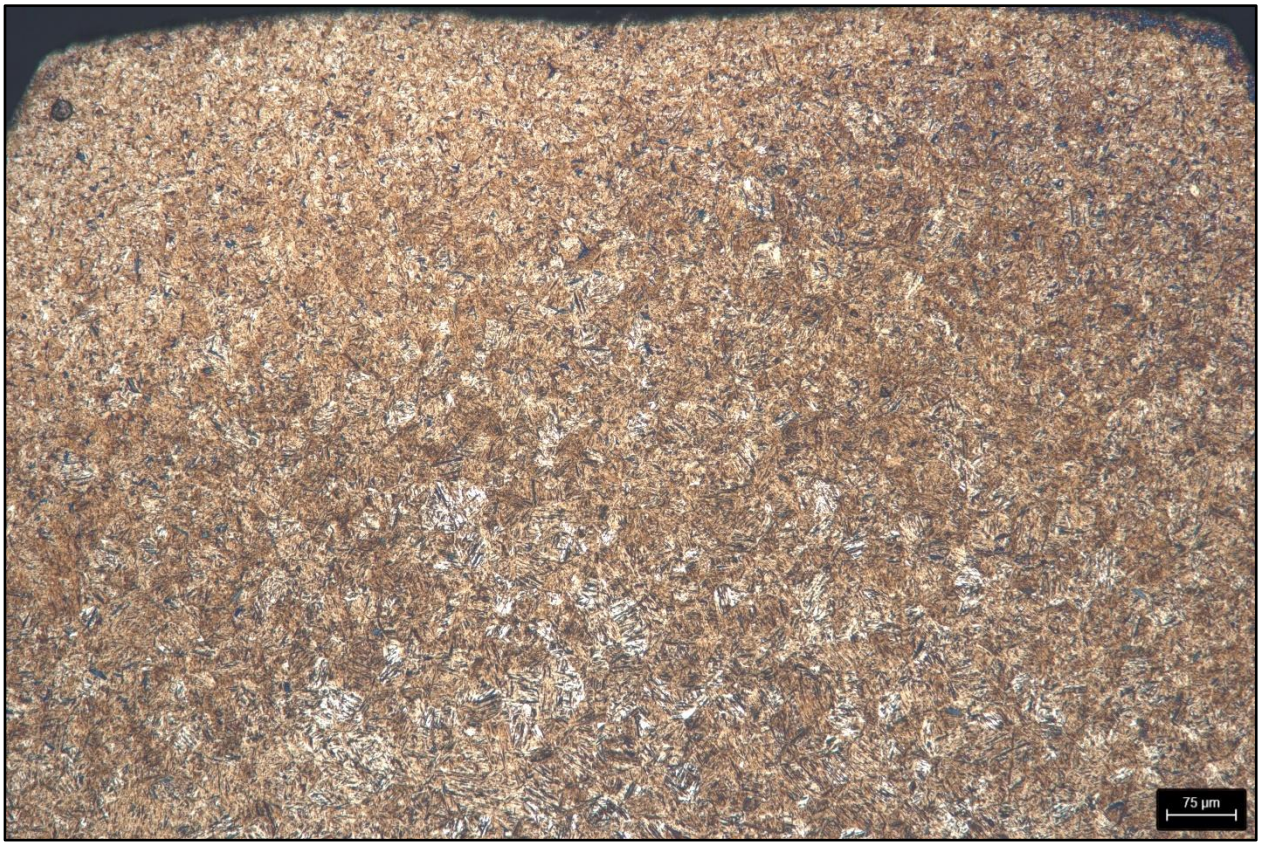


Figure 10: The microstructure after etching with 3% nitric acid – 100 x.

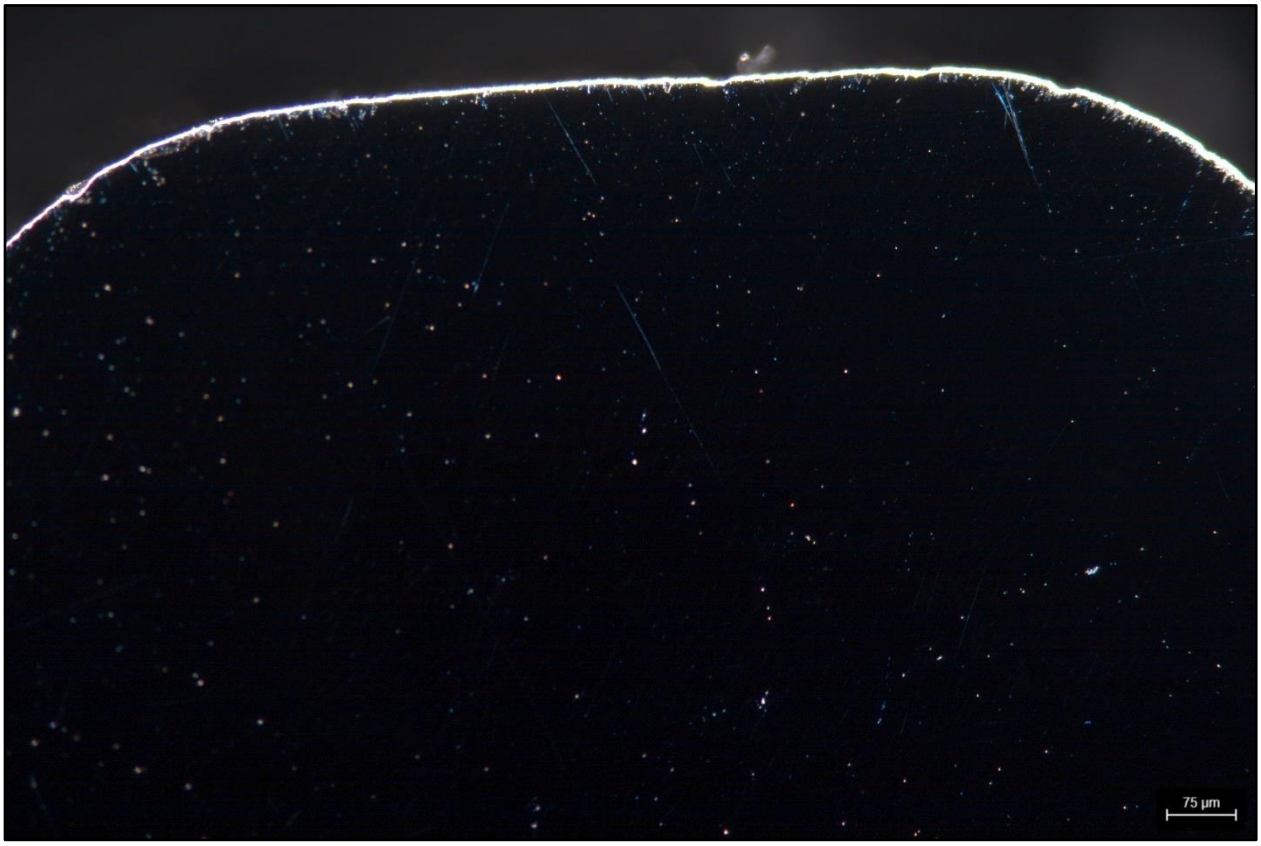


Figure 11: Dark field image to see all the scratches after preparation – 100 x.

QATM-Preparation method

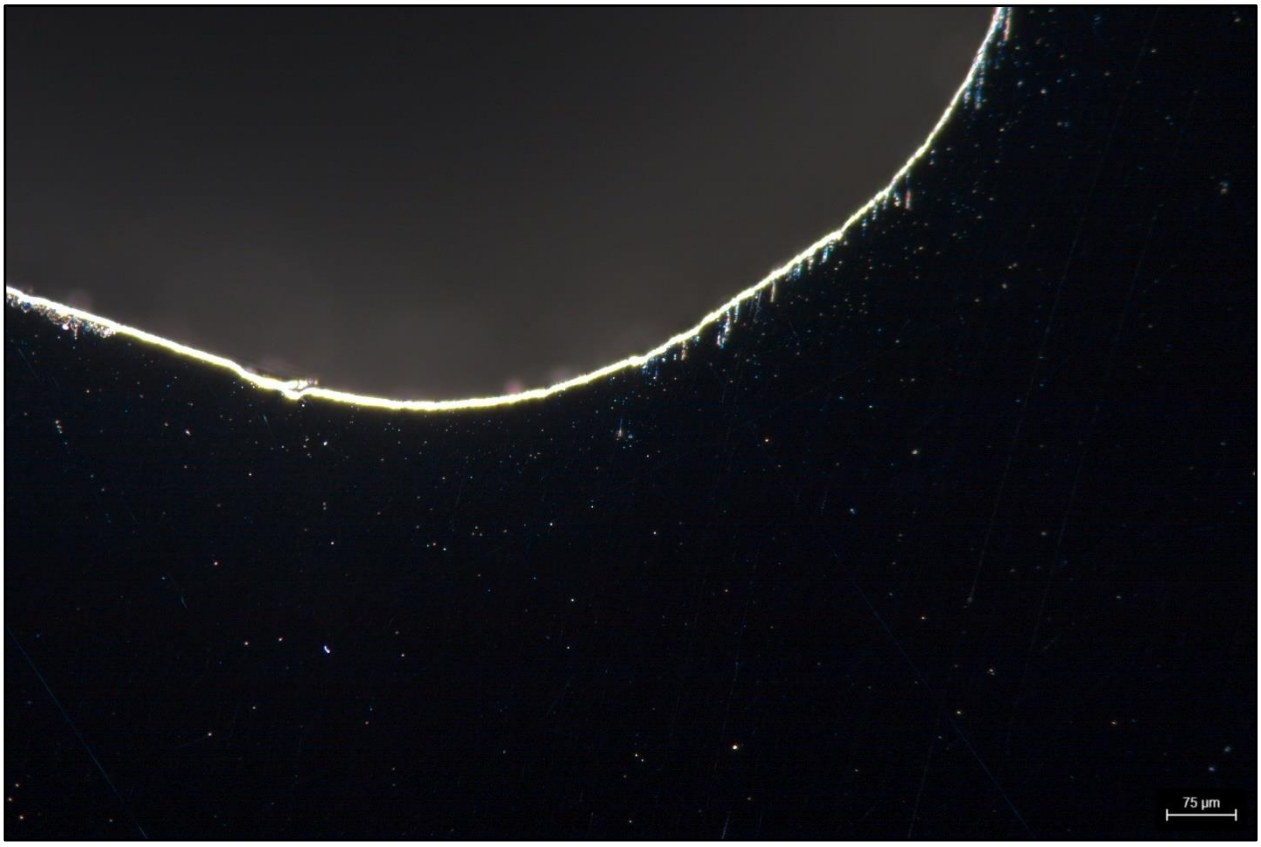


Figure 12: Dark field image to see all the scratches after preparation – 100 x.

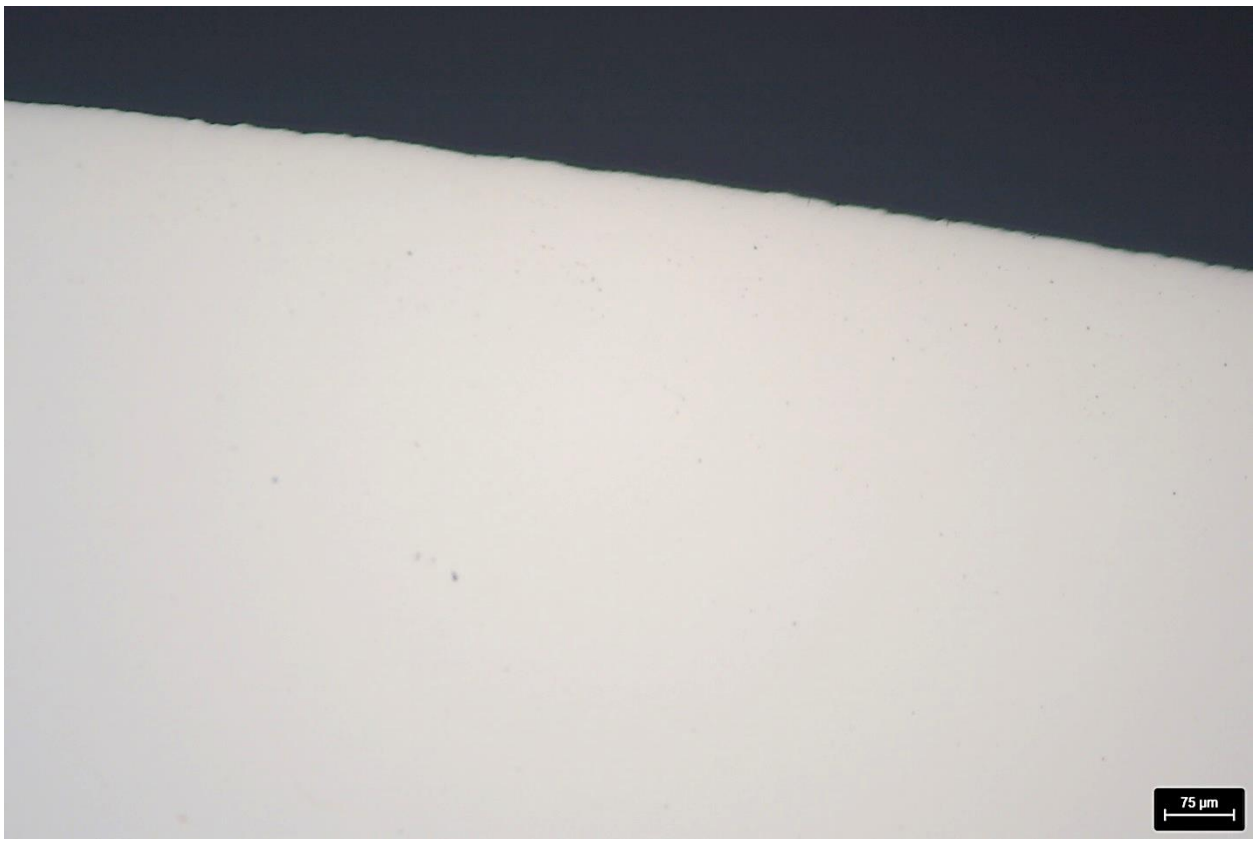


Figure 13: The outer diameter of "MRA" ring sample before etching – 100 x.

QATM-Preparation method

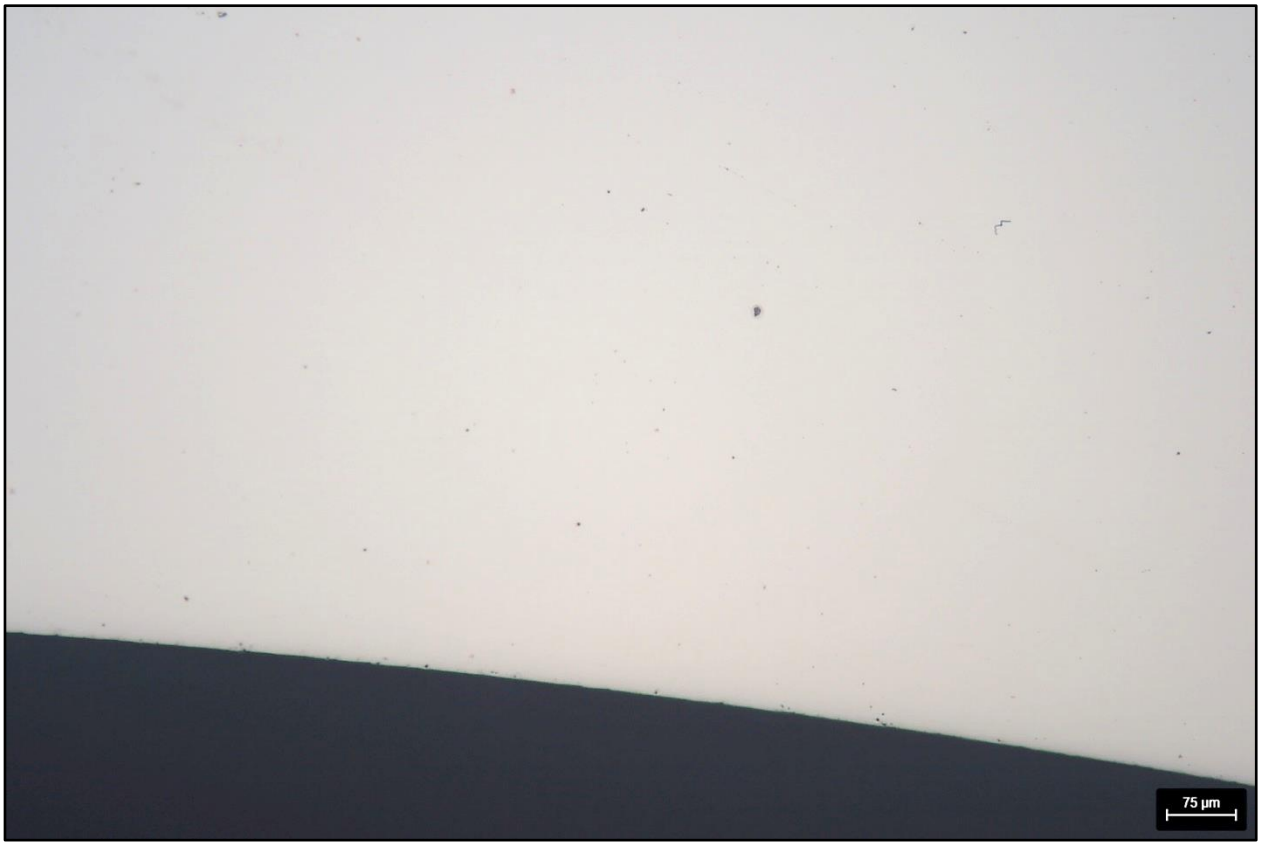


Figure 14: The inner diameter of "MRA" ring sample before etching – 100 x.

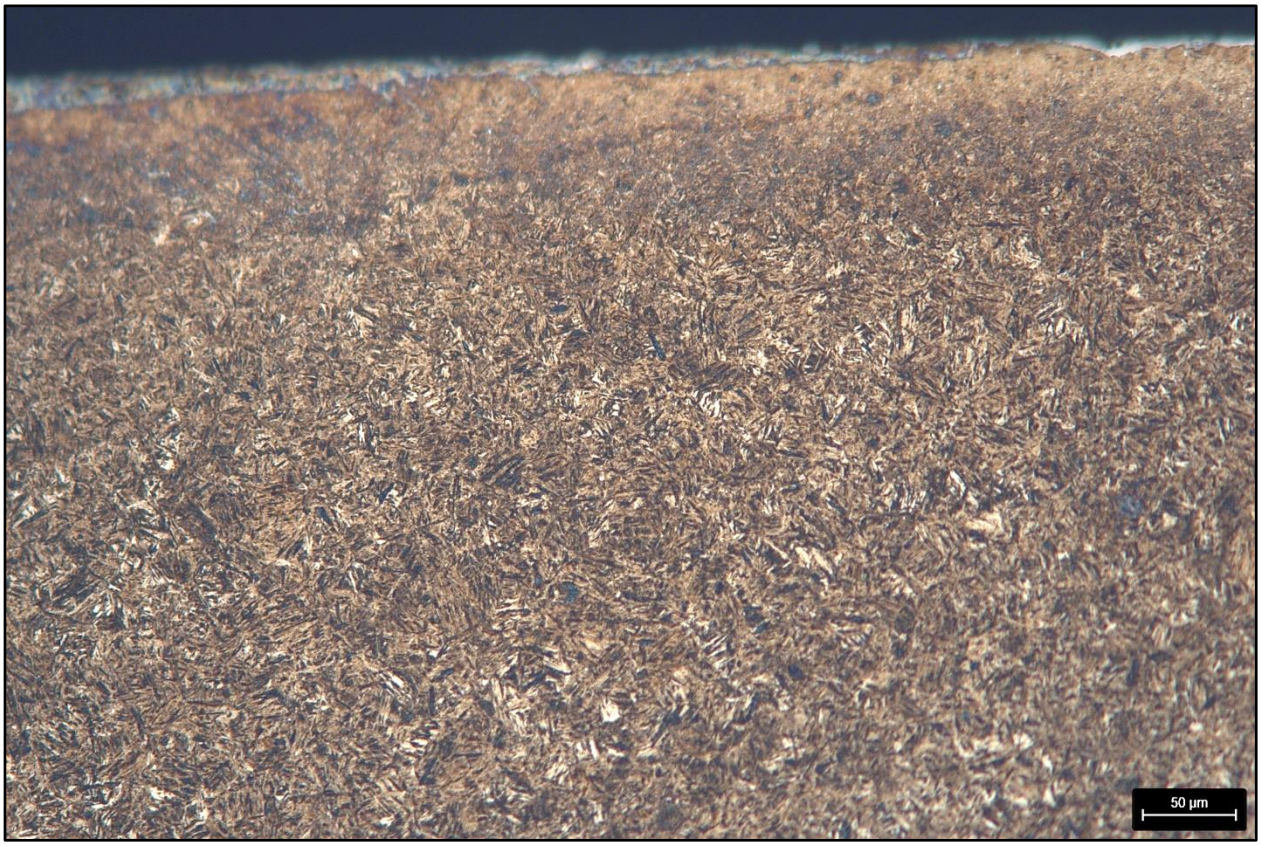


Figure 15: The outer diameter of "MRA" ring sample after etching – 100 x.

QATM-Preparation method

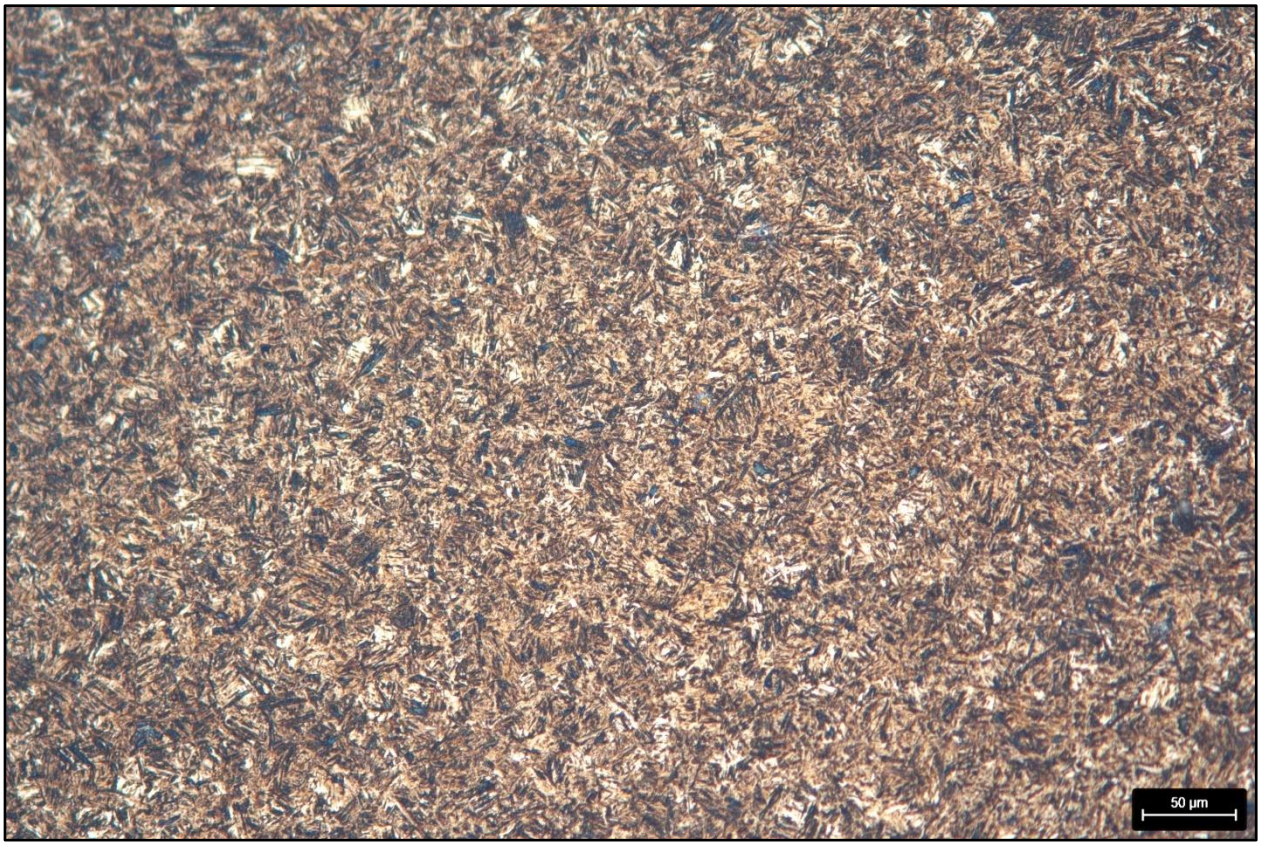


Figure 16: The core zone microstructure of "MRA" ring sample after etching – 200 x.

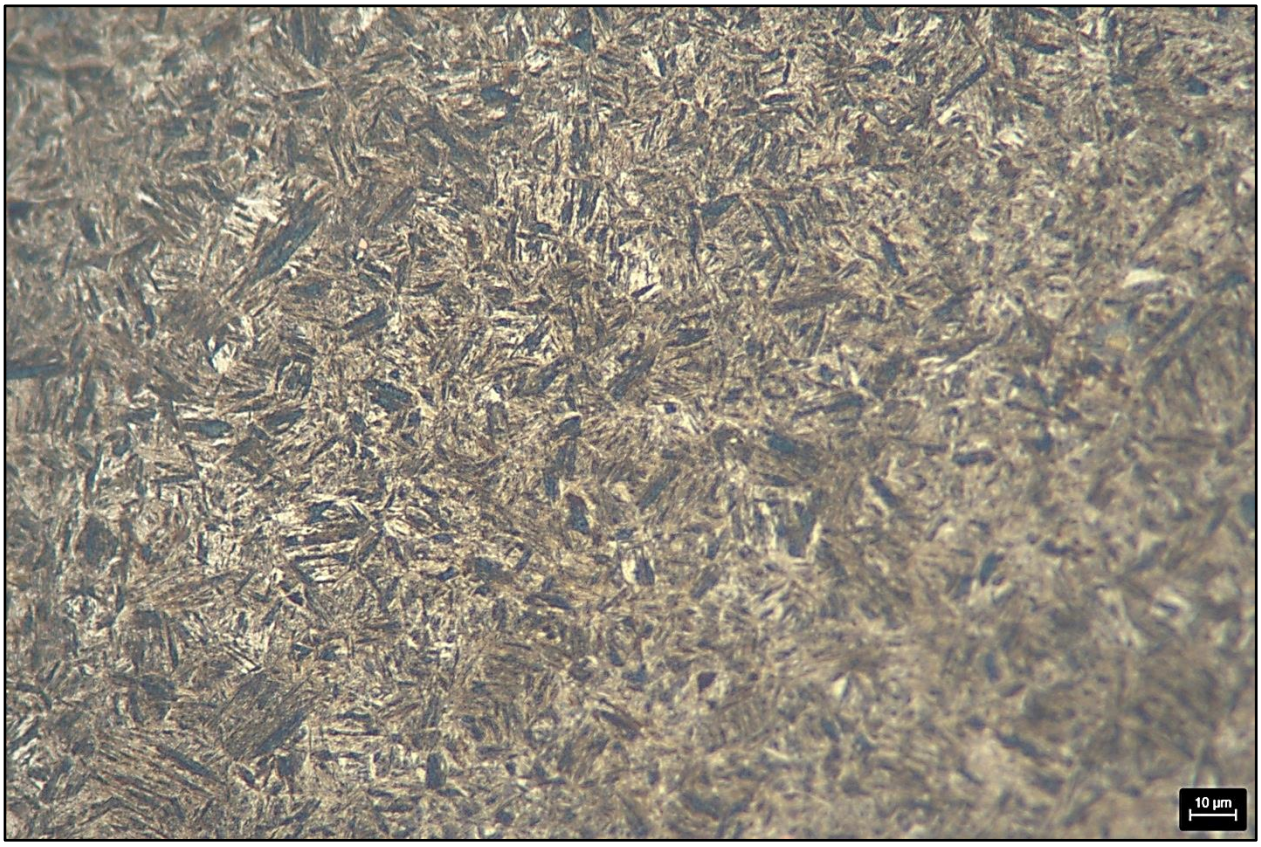


Figure 17: Figure 15 with higher magnification– 500 x.

Conclusion:

1. Our suggestion is to mount the samples before the grinding and polishing process. Mounting the samples can save time and consumables. For instance, the lifetime of the polishing cloths using mounted samples is 10 times higher than using unmounted samples.
2. Polishing and grinding with the combination of Qgrind XL + Qpol 250 Bot takes about 26 minutes. There is a manual step to remove the sample holder from the Qgrind XL and place it in the Qpol 250 Bot. As this step must be done manually, the operator cannot leave the lab and must wait until the first step is finished.
3. The same process with the Qpol 300 Bot takes 24 minutes, but here with two heads, more than one sample holder can be prepared simultaneously, and the device can be filled with 10 sample holders (in the full version), which takes about 3 hours for the preparation, and in this time the operator can do other tasks, and there is no need for anyone to supervise the process.
4. This means that when preparing with the combination of two machines or the Qpol 300 Bot, the time difference is only marginal (approximately 2 minutes). However, using the Qpol 300 Bot is binding less workforce so that one operator can be saved.
   For example, the operators can put 10 new sample holders in the evening into the Qpol 300 Bot and start the process. In the next 3-4 hours the machine will prepare 60 samples without any supervision and the samples will be ready by next day.
5. No problems have been occurred during the preparation. There were no deformations and scratches to observe. The samples with almost the same hardness can be prepared with the same preparation method. For this preparation there is no need of extra grinding steps.