QPR sample polishing update

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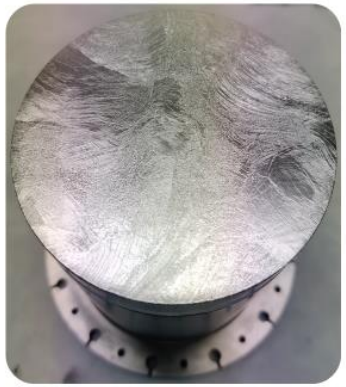
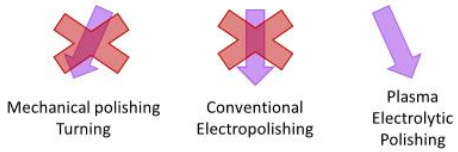
Recall from last meeting

Nb QPR sample



Initial status of QPR A1 sample:

1. Significant rough surface
2. Lines and various imperfections after BCP.
3. Bulk Nb (no welding on the top part)



Longer treatments results

After a long treatment:

1. Well polished the disk, almost dissappeared lines.
2. Disk defects are smoothed, not removed.
3. Some signs of oxides (can be improved…)
4. Some crater-like defects.

Unknown reasons

Possibly due to the oversaturation of the solution, non-uniform treatment in a close environment, cathode effect…

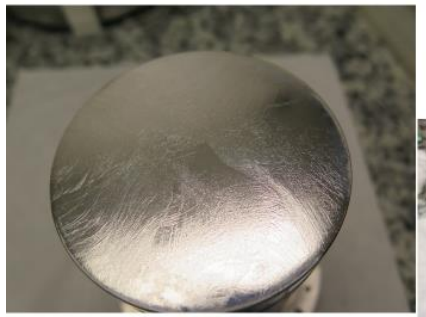
1. 60 min, removed ~100 µm
2. RR = 1,66 µm/min

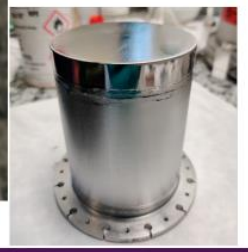
Reported at SRF'21 #SUPTEV002, to be publsihed

Preliminary results

After a short treatment:

1. Well polished external circle.
2. Disk defects are smoothed, not removed.
3. Some signs of oxides.
4. 10 min, removed 17,2 µm
5. RR = 1,7 µm/min



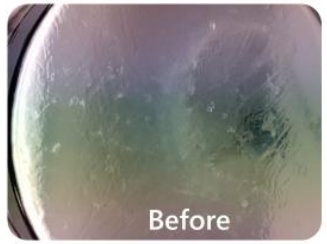


A good sign to go further

Retry in old configuration

21/09/2021

Removed approx. – 14,3 µm (Total of 115 µm)
Rate – 1,4 µm/min
Time – 10 min
300 V, temp 90 C



No new defects
Lack of uniformity
Noticeable smoothing

Optimization of the PEP

PEP setup for QPR sample polishing to be tested soon

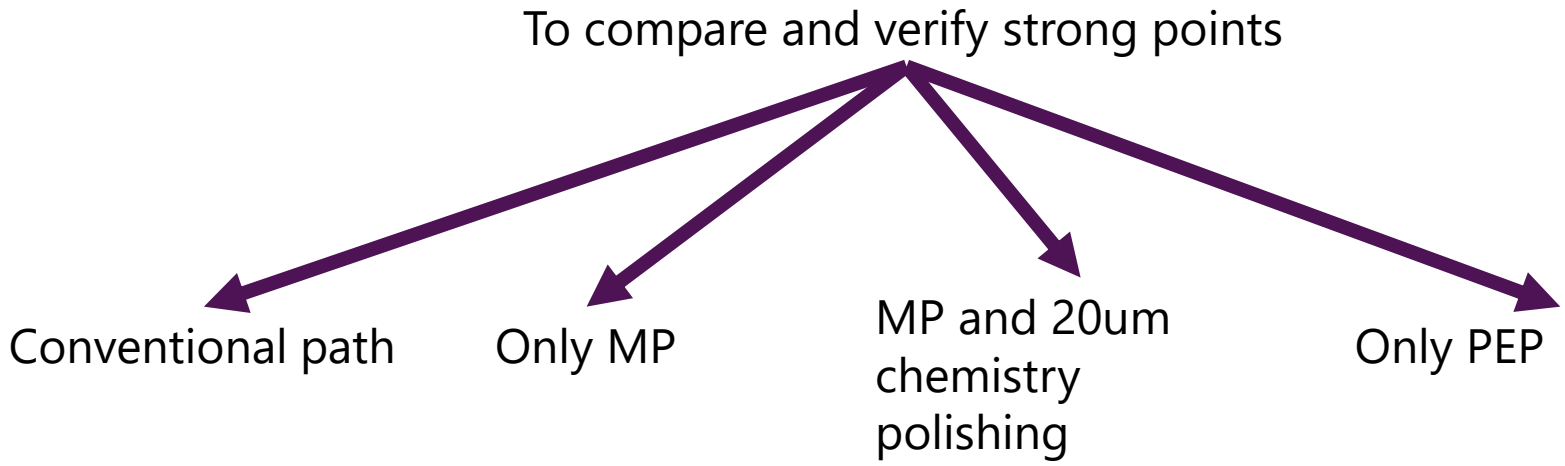
- Bath of 40 L (full size)
- Several cathodes can be placed
- Cathode: Aluminium or stainless steel
- Heating by electrolyte resistance
- Temperature 80-90 C.
- More uniform treatment, temperature, concentration etc.
- Avoid undesired oxides.
- Local polishing

New setup is ready for the approval.
Chemicals order is being proceeded.
Delay of 1-2 month.

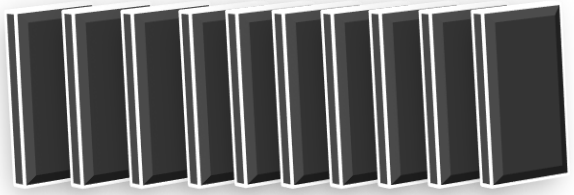
Mechanical polishing and PEP

Metallographic polishing path with final chemistry polishing
courtesy of Oleksandr Hryhorenko

Plasma Electrolytic Polishing



Plan of experiment

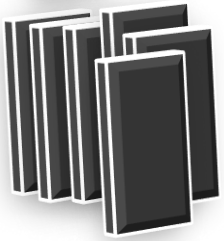


10x Nb samples 31x14,5x3 mm

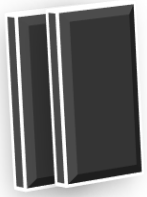
- EBSD (damage evaluation)
- GXRD
- SEM
- Roughness comparison

First samples are arrived. And we did a step-treatment, to evaluate how the surface is changing in time.

1x Reference Nb samples



6x metallographic Nb samples for further PEP



2x PEP (no mech. Treatment) to compare with metallographic Nb samples

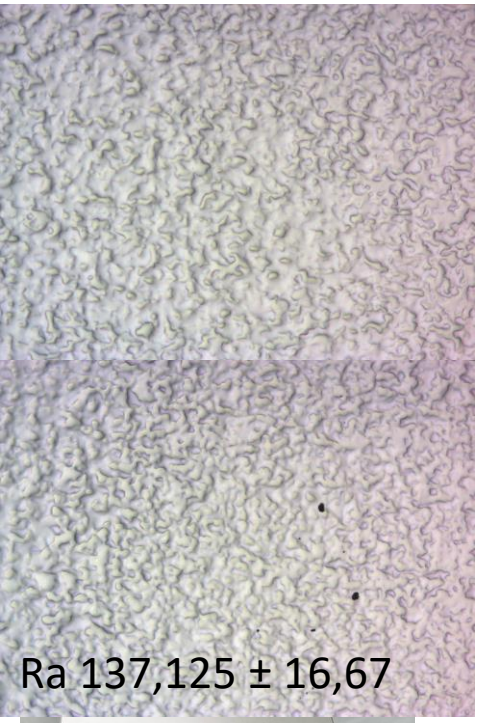
10x Cu samples (to shedule)

Step 20 um removal ✓

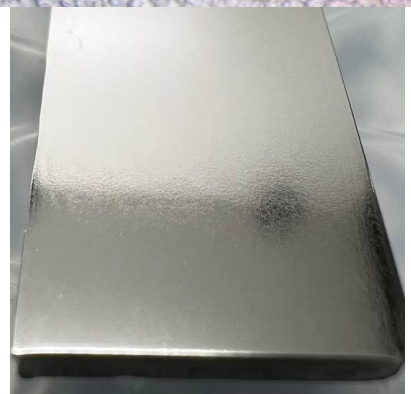
Continuous 20 um removal

Nb 5x magnification; 2nd, 3rd, 4th steps

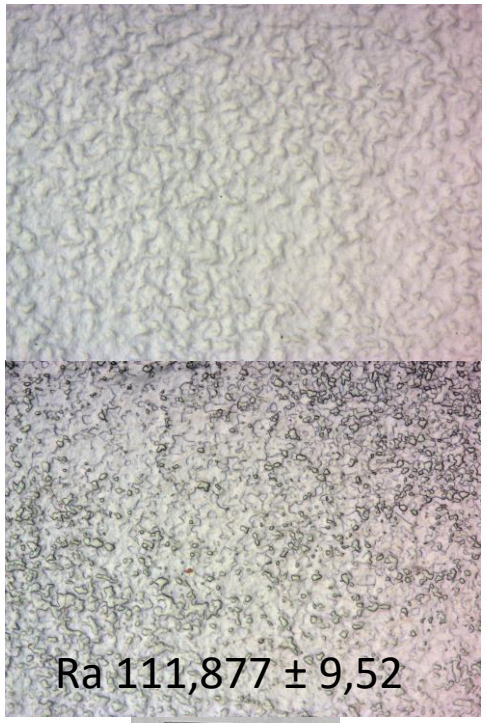
Initial



Ra 137,125 ± 16,67



1min, 4 um



Ra 111,877 ± 9,52

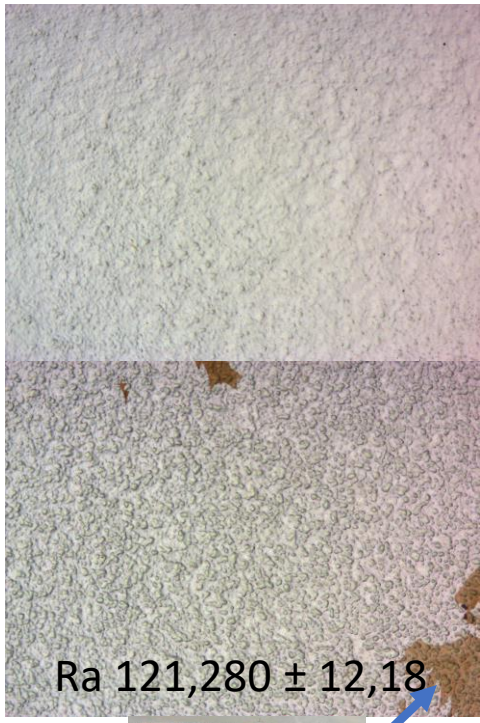
1min, 3 um

Ra 100,827 ± 9,50

1min, 3 um

Ra 122,607 ± 16,84

1,5 min, 3,5 um



Ra 121,280 ± 12,18

Local spots of oxidation

Nb 5x magnification; 4th , 5th steps

2 min, 5 um

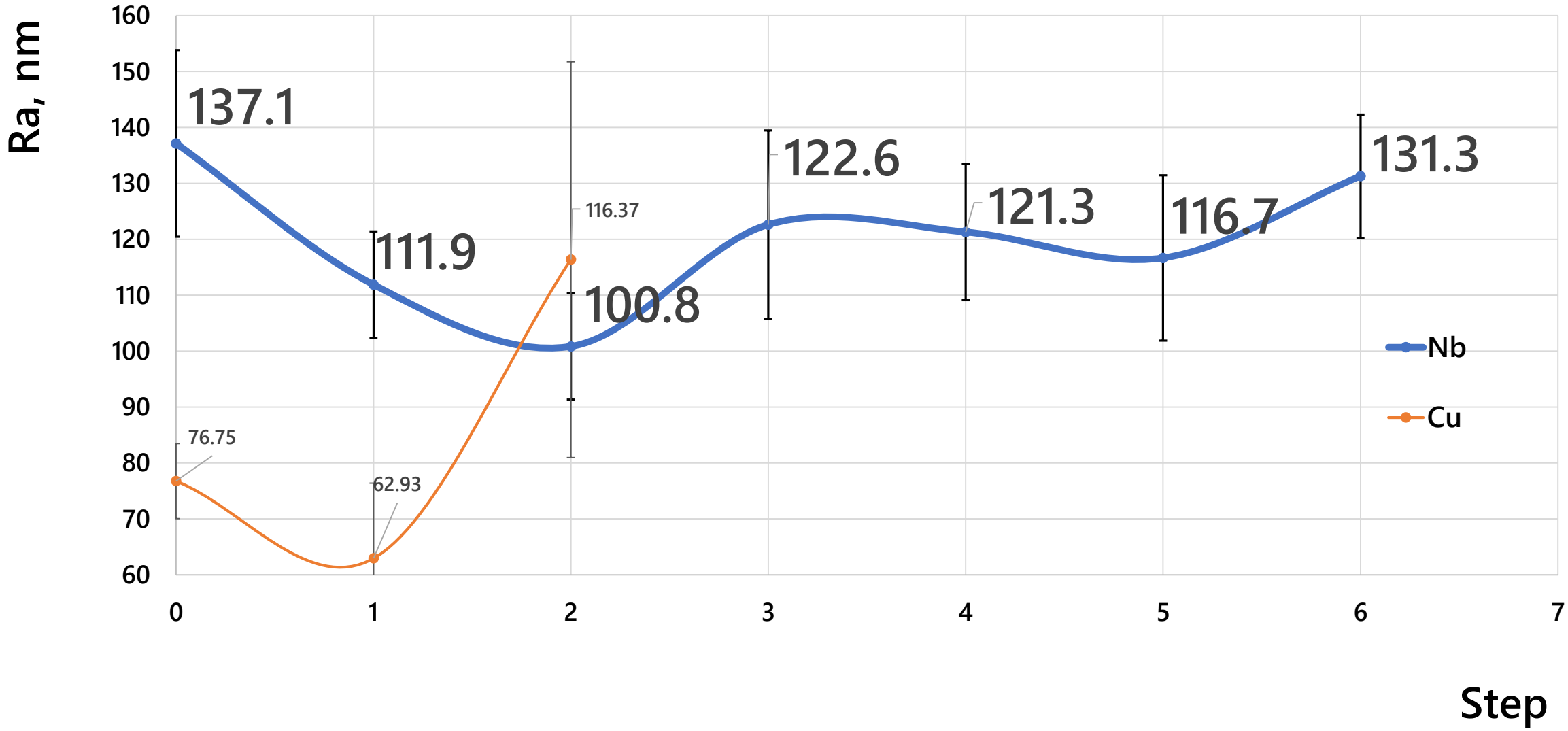
Ra 116,651 ± 14,80

2 min, 4,46 um

Ra 131,271 ± 11,03

Different spots on the sample shows different microstructure

Roughness vs step



Voltage1	Time1 (min)	Working temp(°C)	mass before	mass after	delta m	Removed um	RR, um/min	AREA, cm2
310	**60**	83	11.05	9.20	1.85	**239**	4	9

Future steps

QPR polishing / new system

1. Before the end of 2021
   to test a new setup
2. Verify possible problem and eventually
   deliver the A1 Nb QPR sam

Research

1. 20 um removal in one shot
2. Comparison with step removal samples
3. Further characterization at Orsay