Progress at INFN

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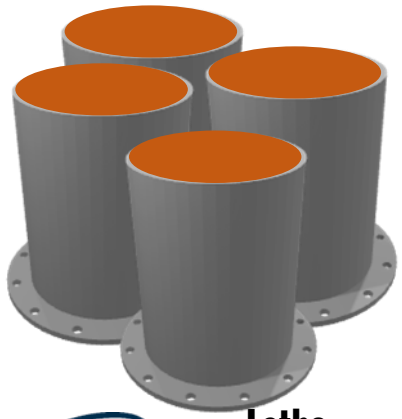
Workflow of the Experiment

GOAL: Evaluate the effect of planar substrate Cu polishing on RF performance of QPR



Lathe machining

SUBU chemical polishing

EP Electropolishing

UNIVERSITÄT SIEGEN

STFC ASTeC

DC Magnetron Sputtering

DC Magnetron Sputtering

DC Magnetron Sputtering

DC Magnetron Sputtering

HZB Helmholtz Zentrum Berlin

RF Tests

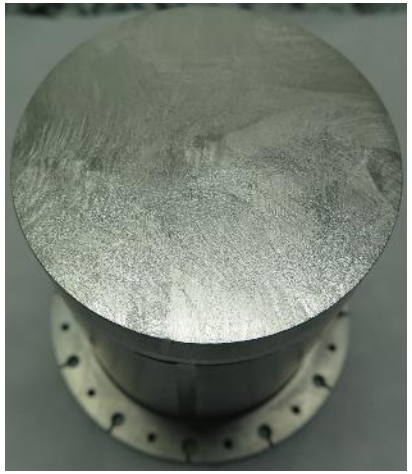
MECHANICAL MACHINING

POLISHING

COATING

RF TEST

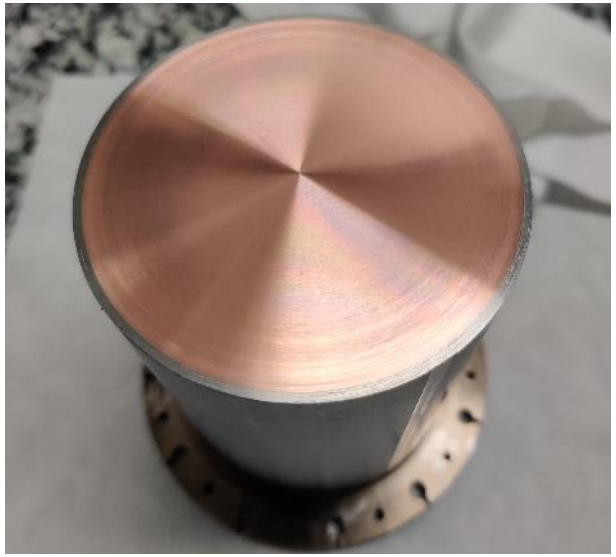
QPR status table

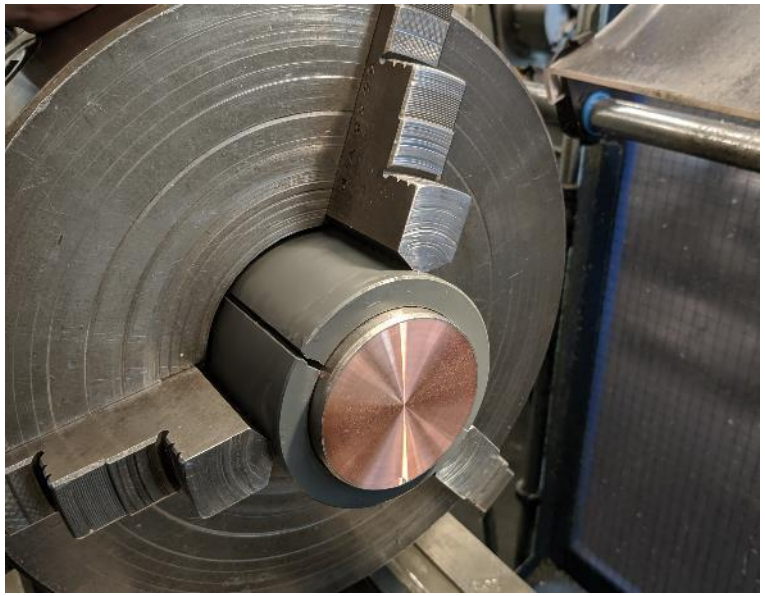


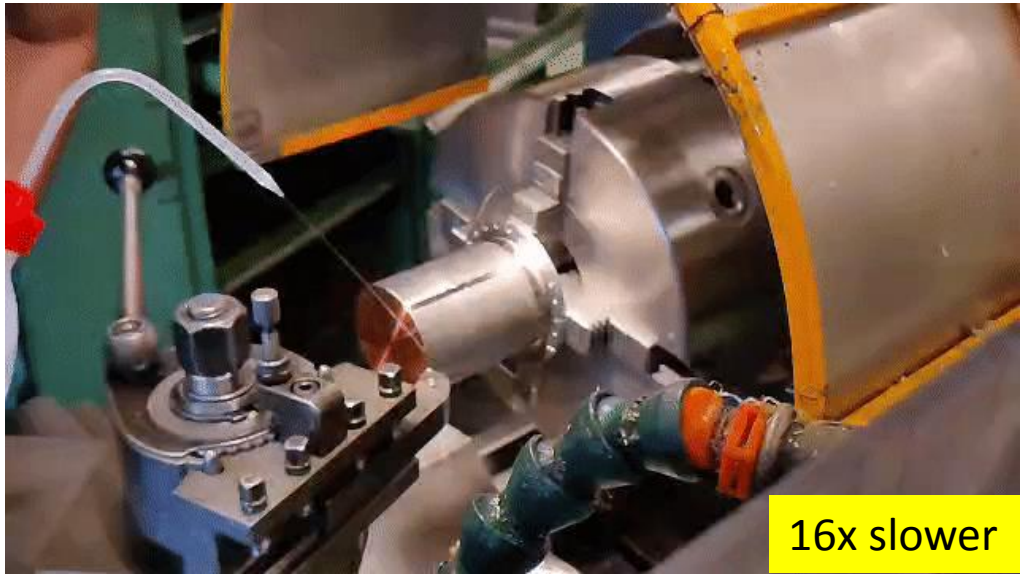
QPR	Status	Treatments done		To be done
Test (Cu, no flange)	Used for machining and polishing test	Lathening	SUBU, EP	
B1 (Cu)	Polished at INFN, coated at STFC, crack on the welding	Lathe (650 µm)	SUBU (6 µm)	Should be substituted
B2 (Cu)	Polished at INFN, coated at Siegen, tested at HZB	Lathe (50 µm)	SUBU (7 µm)	-
B3 (Cu)	Polishing at INFN scheduled for early January	Lathe (129 µm)		EP
B4 (Cu)	Polished at INFN, Shipped to STFC, coating scheduled for December	Lathe (175 µm)	EP (12 µm)	Nb sputtering
B5 (Cu)	Polished at INFN, Shipped to STFC, coating scheduled for December	Lathe (45 µm)	SUBU (6 µm)	Nb sputtering
A1 (Nb)	Awaiting schedule			Lathe, EP

Lathening

All 5 QPRs cavities were already machined with Lathe technique to remove approximate from 10 to 90 µm, depending on planarity.

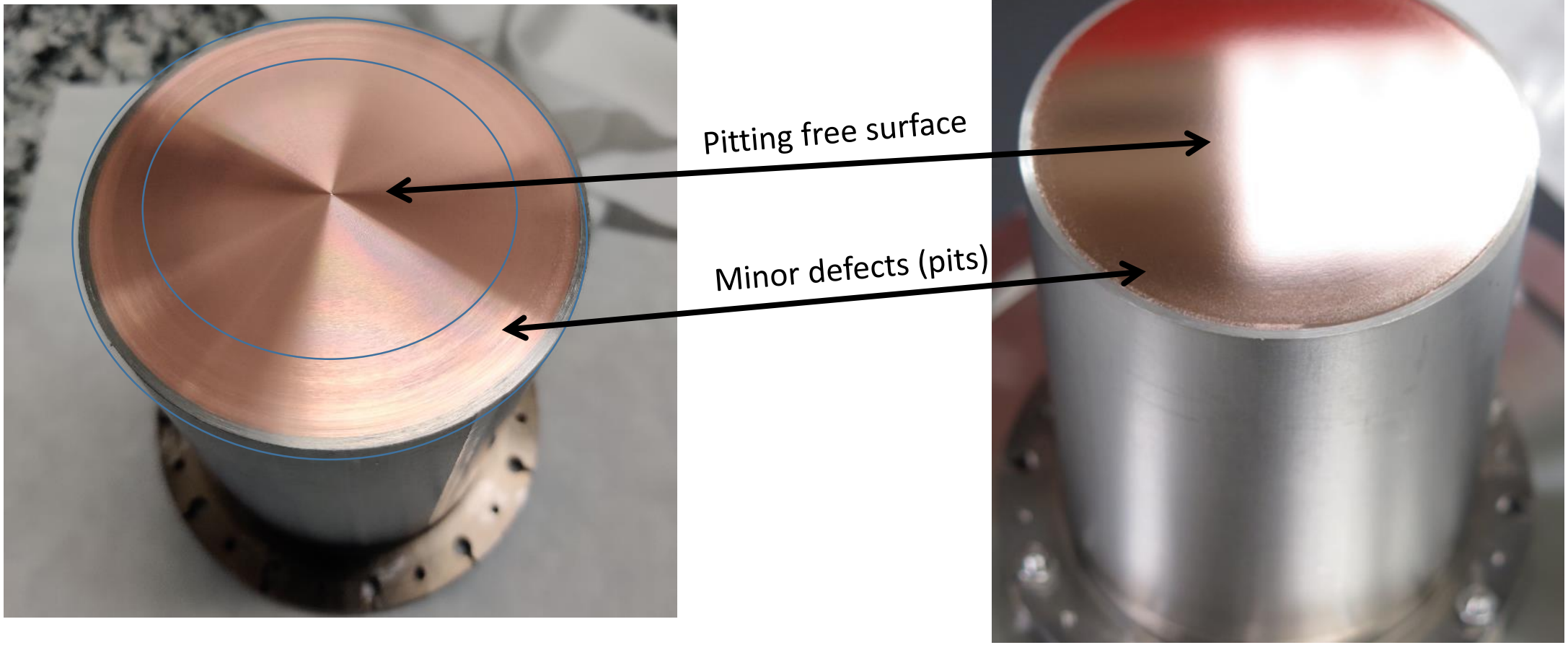






Lathening

We found out, that speed of Lathening affects quality of the surface.
More close to the center – speed is slower. As a result: minor defects close to the edge after EP.



Chemical polishing - SUBU

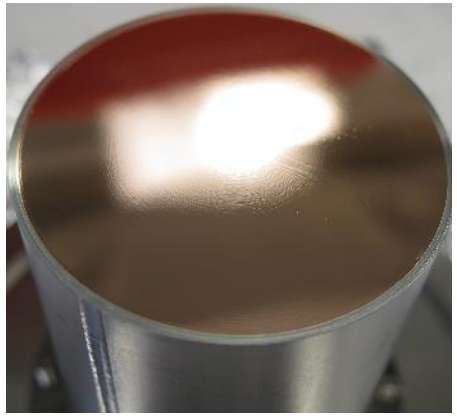
PROTOCOL

#	Treatment	Solution	Time
1	Degreasing	NGL 1740 ultrasounds	5 min
2	Activation	H_3NO_3S, 5 g/l	3 min
3	***Polishing***	***SUBU (T=73 °C)***	***10 min***
4	Passivation	H_3NO_3S, 20 g/l	5 min
5	Rinsing	Demineralized water	1 min
6	Spraying	Ethyl alcohol	-
7	Drying	Nitrogen gas	2 min
8	Packing	SS container under Ar	-

SUBU solution
Sulfamic acid – 5 g/l
$(NH_4)_3Cit$ – 1 g/l
H_2O_2 – 50 ml/l
Butanol – 50 ml/l

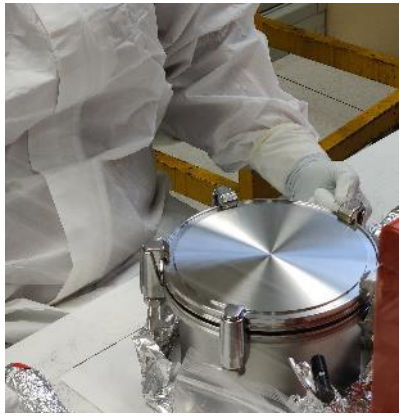
Average removed thickness: 6-9 µm

After machining

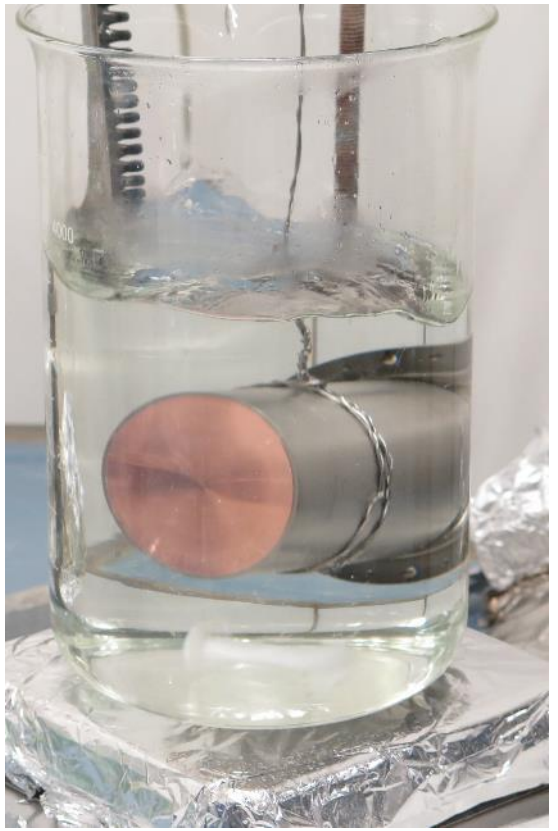


After SUBU

Packing

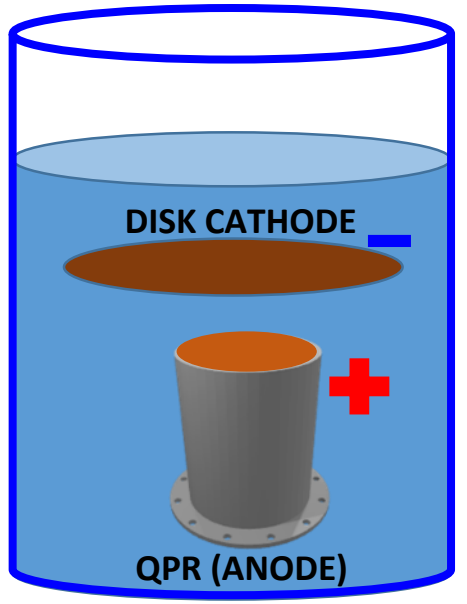


SS container



During SUBU chemical polishing

Electropolishing (EP)



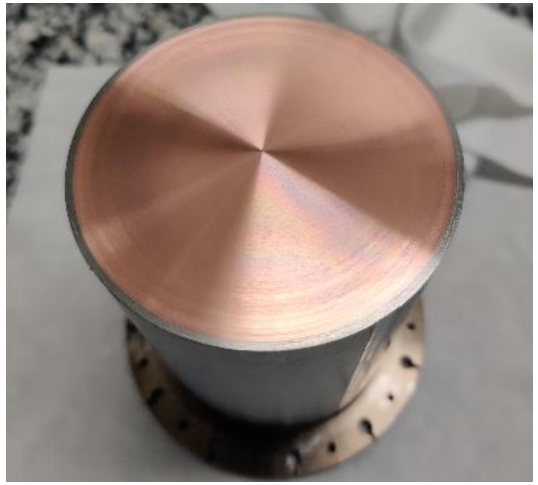
PROTOCOL

#	Treatment	Solution	Time
1	Degreasing	NGL 1740 ultrasounds	5 min
2	Activation	H_3NO_3S, 5 g/l	3 min
3	***Polishing***	***EP***	***40 min***
4	Passivation	H_3NO_3S, 20 g/l	5 min
5	Rinsing	Demineralized water	1 min
6	Spraying	Ethyl alcohol	-
7	Drying	Nitrogen gas	2 min
8	Packing	SS container under Ar	-

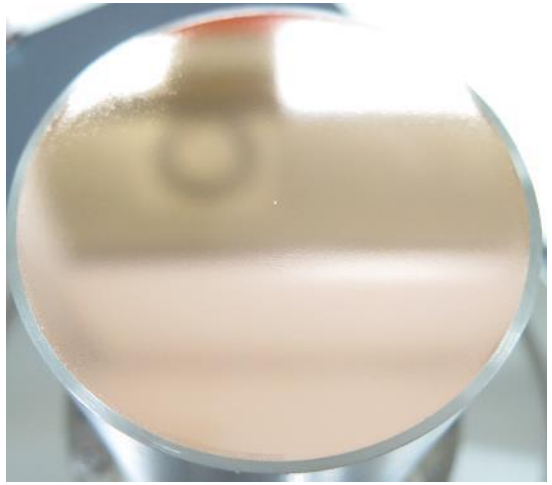
Standard LNL recipe of Copper EP

H_3PO_4:Butanol = 3:2

Simple construction:
Baker, disk cathode and QPR

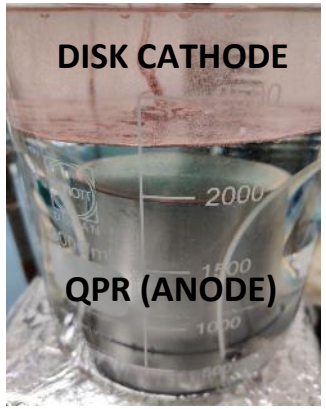


After machining

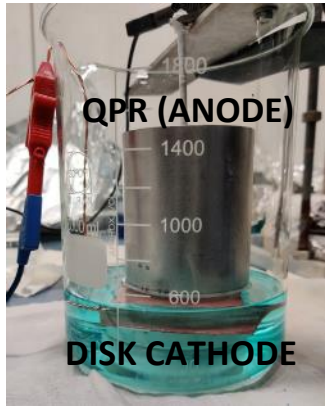


After EP

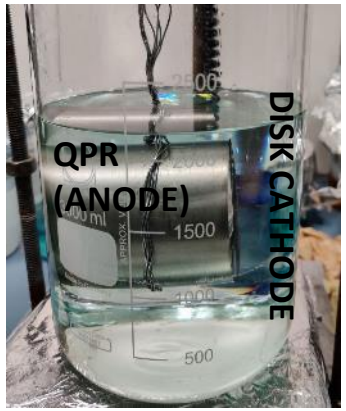
3 Different EP positions tested



VERTICAL 1



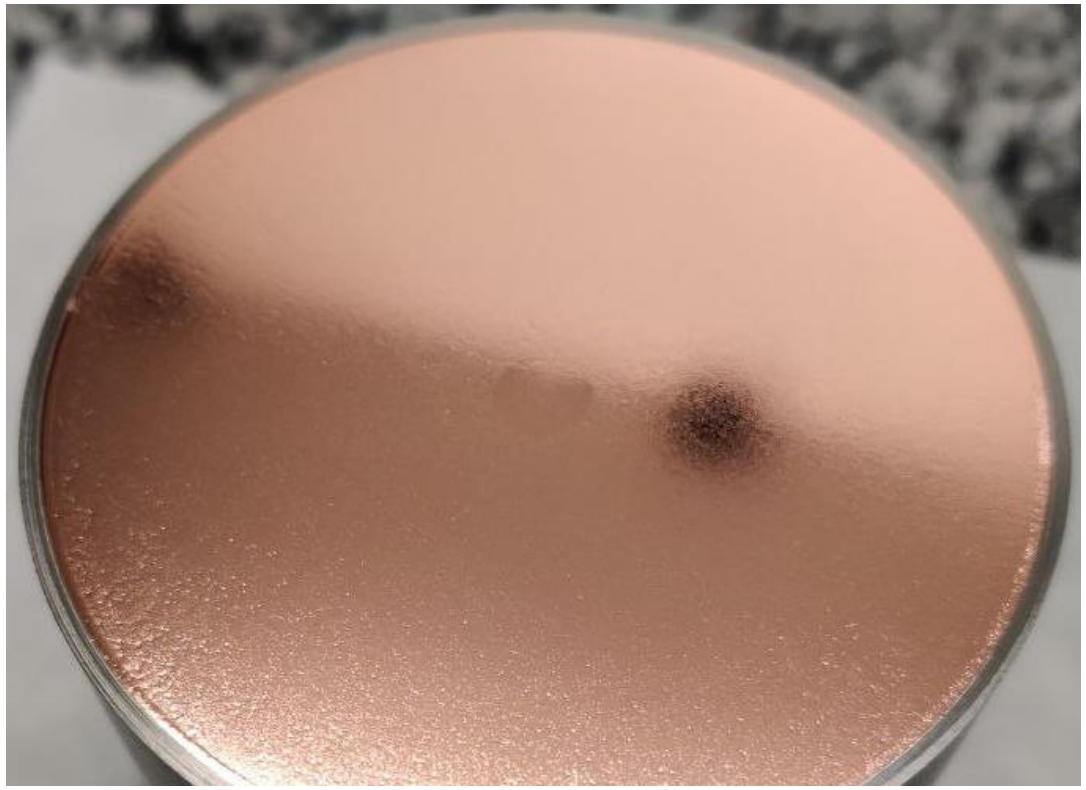
VERTICAL 2



HORIZONTAL

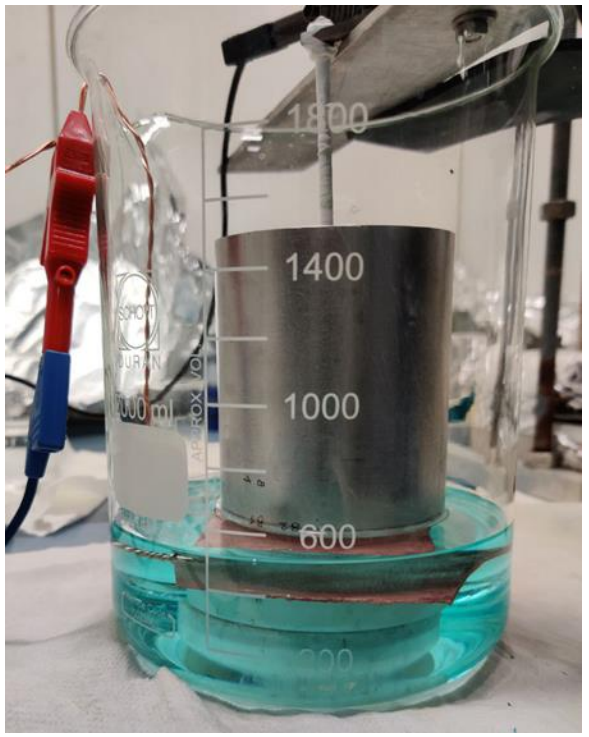
Electropolishing (EP)

Vertical 2

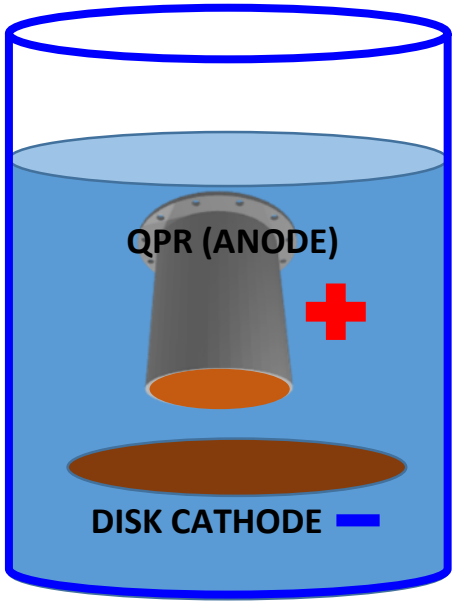


Too much pits and less reflective than ussualy obtained

QPR (ANODE)



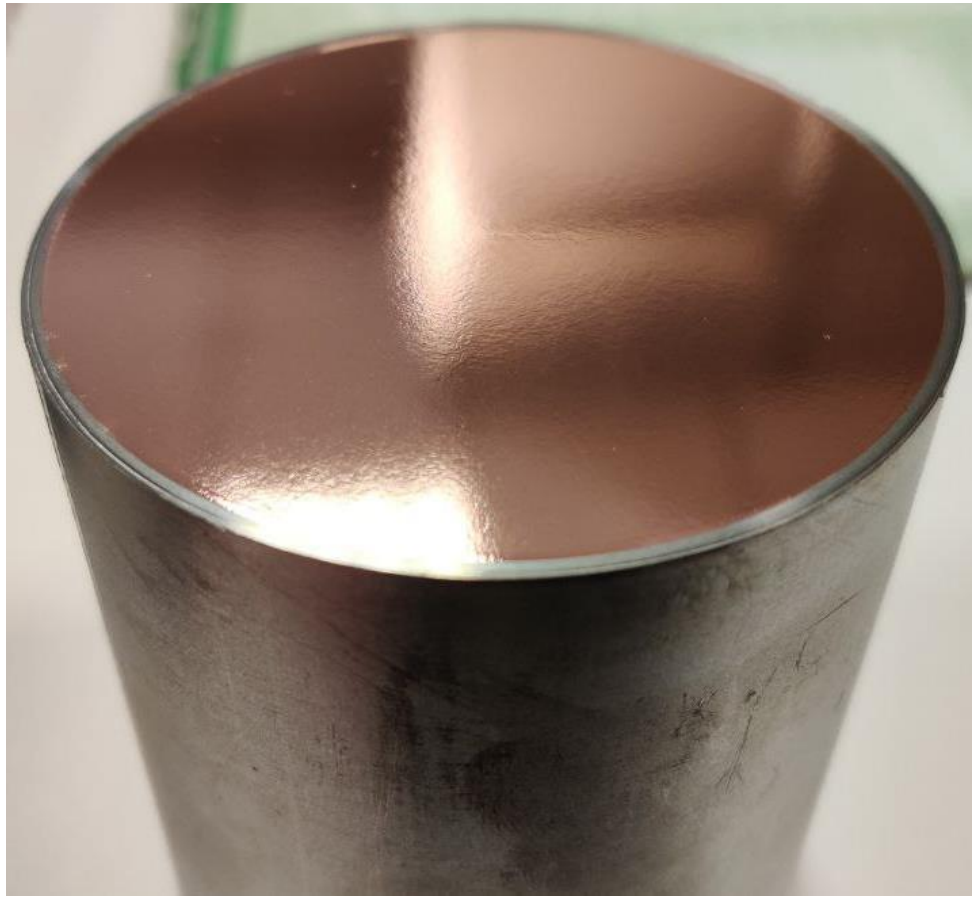
VERTICAL 2
DISK CATHODE



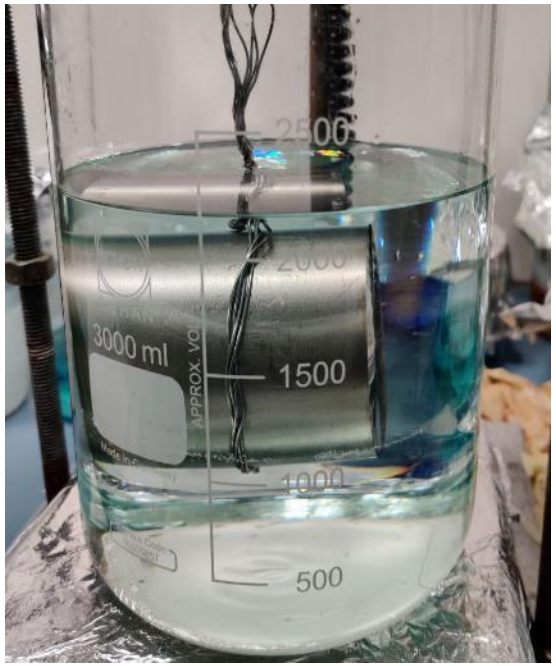
Electropolishing (EP)

Horizontal

Wavy surface, due to movement of viscous layer



QPR
(ANODE)



DISK CATHODE

HORIZONTAL