CURRENT STATUS OF THE ALPI LINAC UPGRADE FOR THE SPES FACILITIES AT INFN LNL

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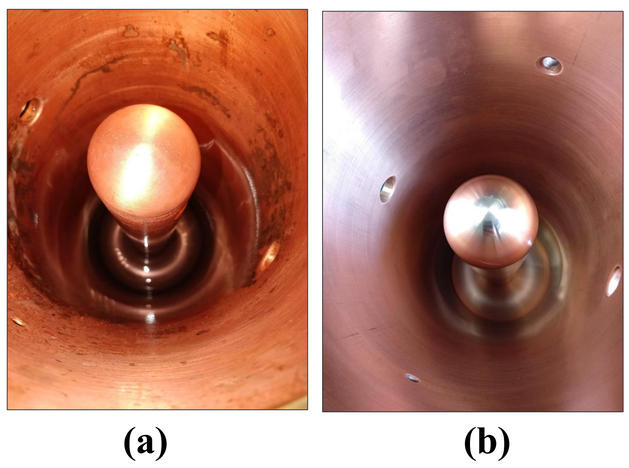
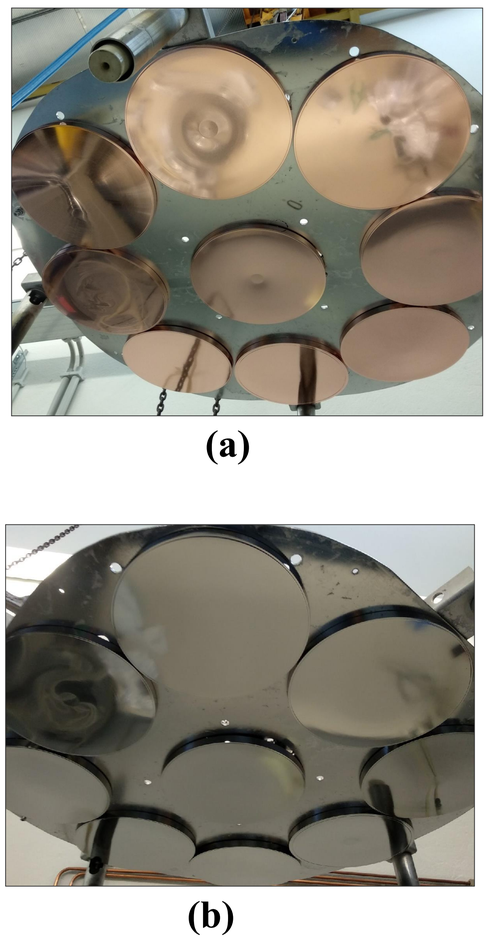
Introduction. The ALPI linac upgrade at LNL, as part of the SPES facility, consists of 2 additional cryostats in the high-β section. As part of this upgrade, the ALPI QWR cavities and plates production and measurement technology was restarted at LNL. The coating and measurement systems were upgraded and 5 QWR cavities were produced and tested.

Nb/Cu high-β QWR and plates production



(a) (b) (c) (d)

Fig 1: View of the surface of ALPI QWR cavity after: (a) – machining of the copper substrate; (b) – tumbling; (c) – chemical and electrochemical preparation; (d) – sputtering of the cavity.



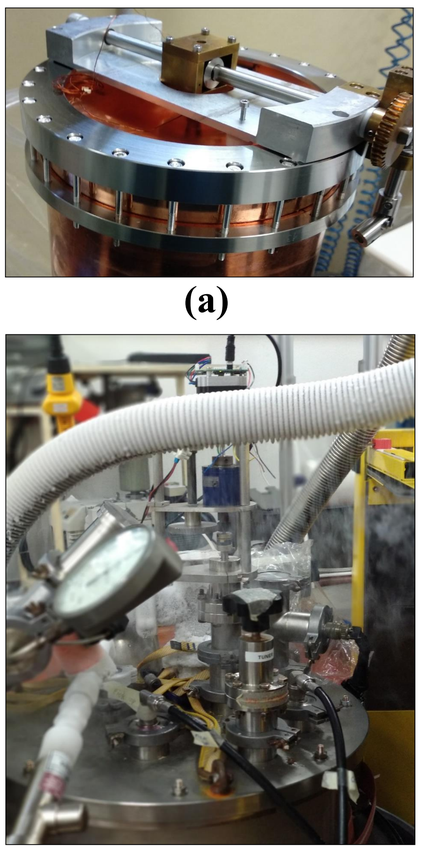
(a) (b)

Fig 2: View of the QWR coated plates after: (a) – chemical and electrochemical preparation; (b) – sputtering of the plates.

Substrate surface preparation		
1	Tumbling	12 hours
2	Electropolishing	Solution (H_3PO_4, Butanol)
3	SUBU Preparation	Solution (Sulfamic acid, ammonium citrate, butanol, H_2O_2)
4	Passivation	Solution (sulfamic acid)
5	High Pressure water rinsing	

Baking process		
Parameter	Cavity	Plate
Chamber temperature, [°C]	120 – 200	100 - 120
Substrate temperature, [°C]	400 – 450	300 – 350
Time, [hours]	72 - 96	
Sputtering process		
Sputtering pressure, [mbar]	0,1 – 0,2	
Cathode current, [A]	3,25 – 3,5	12 – 14
Bias voltage, [V]	120 – 130	100 – 120
Sputtering cycle time, [min]	15	6
Number of cycles	16 – 20	10 – 12
Initial cavity temperature, [°C]	300	200

Superconductive cavity proprieties



(a) (b)

Fig 3: View of the plate-cavity assembling system (a) and cryostat during low temperature measurements (b).

Baking process	
Cavity temperature, [K]	330 – 350
Time, [hours]	24 - 72
High temperature conditioning	
Cavity temperature, [K]	330 - 350
Power, [W]	10 – 72
Time, [hours]	48 – 96
Cooling down of the cavity until 4 K	
Low temperature conditioning	
Cavity temperature, [K]	4
Power, [W]	15 – 20
Time, [hours]	1 – 4
Purified Helium gas pressure, [mbar]	$5 \cdot 10^{-5}$
Low temperature cavity measurements	

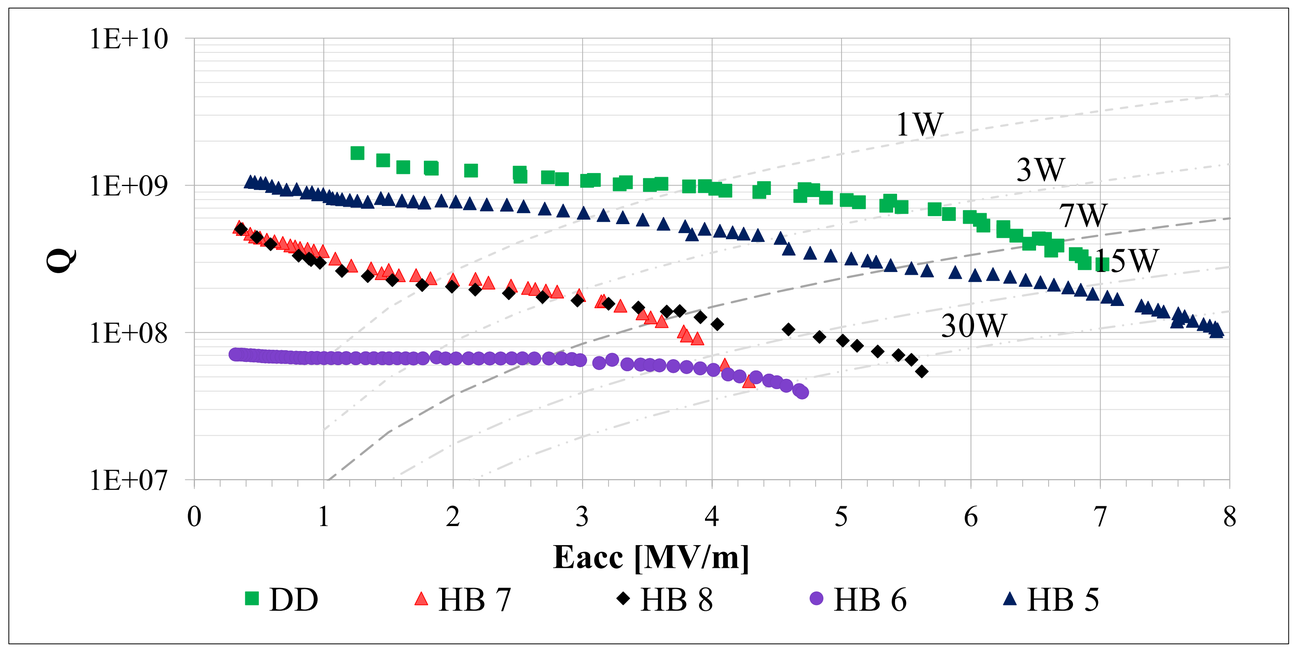


Fig 4: Q-slope of the ALPI QWRs.

Dependance between **superconductive properties** and **ΔT** of the cavity and plate was observed. To **improve** the **thermal and electrical contact** between the cavity and the plate, **the mounting system** has been **modified**.
Within the produced cavities, **2** QWRs **overpassed target** superconductive properties, **1** will be **remeasured** with modified plate – cavity assembling system and **2** will be **re-sputtered.**

Cavity №	Q_0	Eacc 7W, [MV/m]	Q (at 7W)	ΔT (plate – cavity)
Target		**>4,5**	**>E+8**	
DD	1,1E+9	6,7	3,9E+8	1,7
HB 5	7,6E+8	5,5	2,8E+8	1,66
HB 8	1,5E+8	3,8	1,4E+8	2
HB 7	3,2E+8	3,7	1,35E+8	2,8
HB 6	7,6E+7	2,6	6,7E+7	3,2

Conclusion. Several produced cavities (DD and HB 5) showed appropriate superconductive properties with respect to the predefined target for ALPI linac. The production processes and low temperature testing technologies of the high-β Nb/Cu ALPI QWR cavities were confirmed. Deposition and evaluation of the next QWRs for the ALPI upgrade is in progress.