

POLITECNICO MILANO 1863

Controlled removal of bronze layers Federico Morini

Advisor: Anne-Marie Valente Feliciano Supervisor: Silvia Franz Tutor: Massimiliano Bestetti

July-September 2019



Aim



[1] E. Barzi, S. Frznz, F. Reginato, D. Turrioni, M. Bestetti, *Synthesis of Superconducting Nb*₃*Sn Coatings on Nb Substrate*, Superconductor Science and Technology, 2016

Solutions for Chemical Etching

Treatment	Time
HCI + HNO ₃	5 minutes
Diluted HCl + HNO ₃	10 minutes
Diluted Aqua Regia	20 minutes
Ammonium Copper Chloride Solution	30 minutes
Aqua Regia	6 minutes
Ammonium Persulfate solution	20 minutes

$HCI + HNO_3$









After



Diluted HCI + HNO₃







After



Diluted Aqua Regia







After



Ammonium Copper Chloride solution

Before







After



Aqua Regia Solution

Before







After



Ammonium Persulfate solution

Before







After



Conclusions

Five chemical etching solutions were tested:

- HCl + HNO₃ solution
- Diluted HCl + HNO₃ solution
- o Diluted Aqua Regia
- o Ammonium Copper Chloride solution
- o Aqua Regia
- o Ammonium Persulfate Solution



- Bronze removal was determined by surface and cross-section SEM + EDS analysis
- \circ HCl + HNO₃ was too aggressive (complete removal of the Nb-Sn film)
- Diluted HCl + HNO₃ and diluted Aqua Regia did not affect the bronze layer
- Ammonium copper chloride formed tin chlorides on the surface
- **o** Best results were obtained by using Aqua Regia or Ammonium persulfate solution