This project has received funding from the European Union's Horizon 2020 Research and Innovation programme under GA No 101004730.

Task 9.2 Cavity Production @

4th iFAST WP9 meeting – 17th February 2022

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iFAST

Study in collaboration with

UNIVERSITÀ DEGLI STUDI DI PADOVA

GOALS:

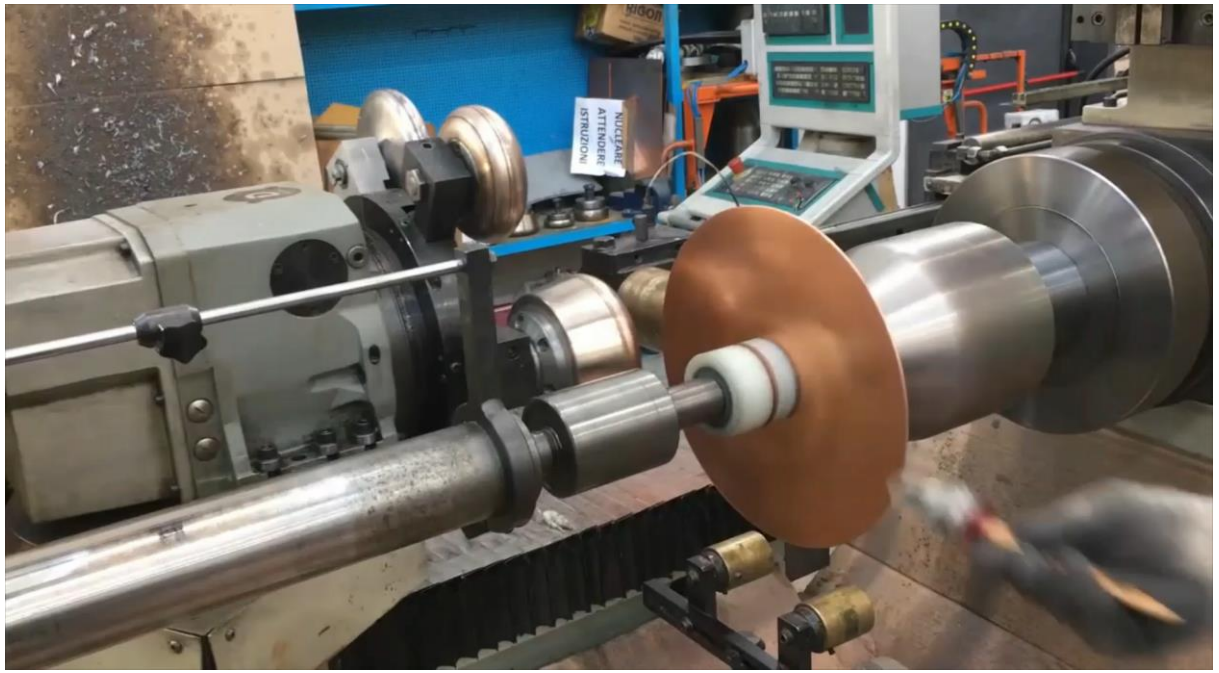
- Move cavity forming process from semi-automatic to fully automatic using CNC machine
- Study annealing temperature
- Reproducibility (in progress)

Methodology

- Samples extracted form 2 Cu OFE sheets 1 mm^2:
  - 18 discs 33 cm diameter
- Not enough for a symmetric cavity (no problem: the cell is the critical part)
- Different production routes tested:
  - with or without intermediate annealing
  - with or without final annealing
  - Different annealing temperature

CNC Machine

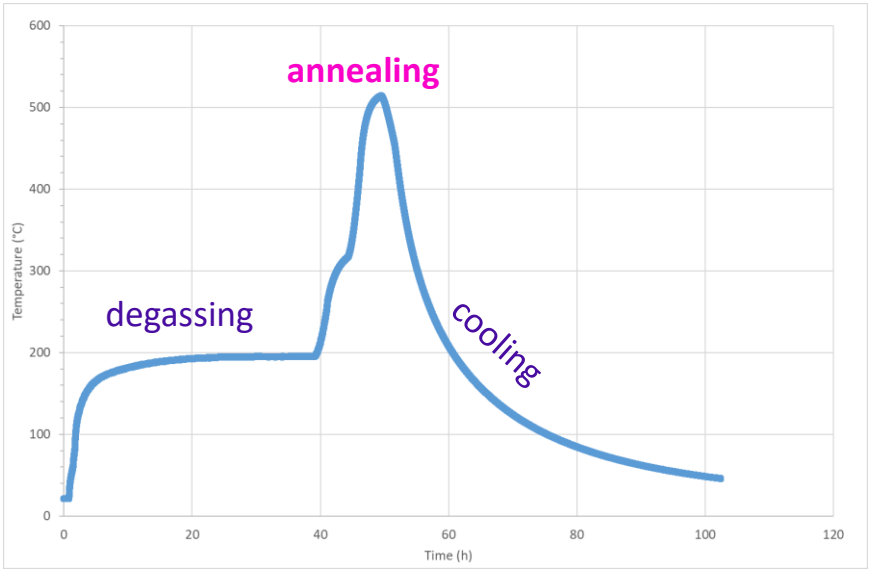
4 step process

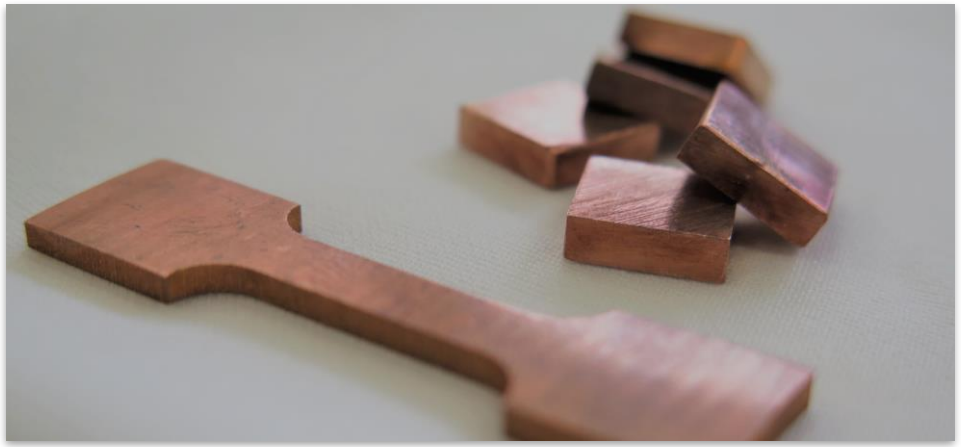


Demonstrated the possibility to use CNC machine to spun a 1.3 GHz cavities (**no intermediate annealing necessary**)

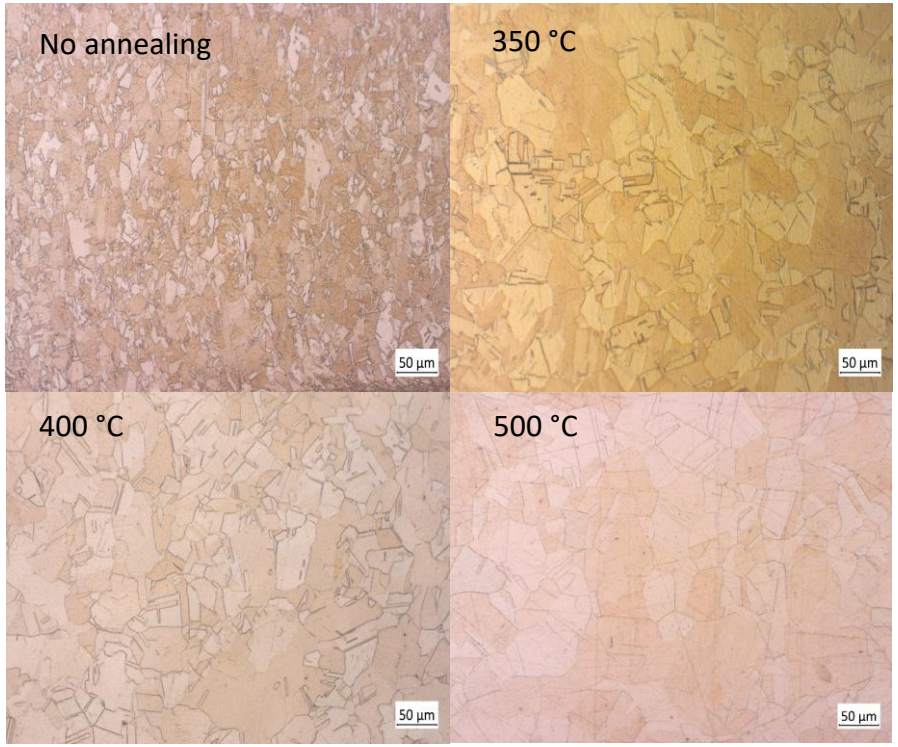
Annealing Temperature

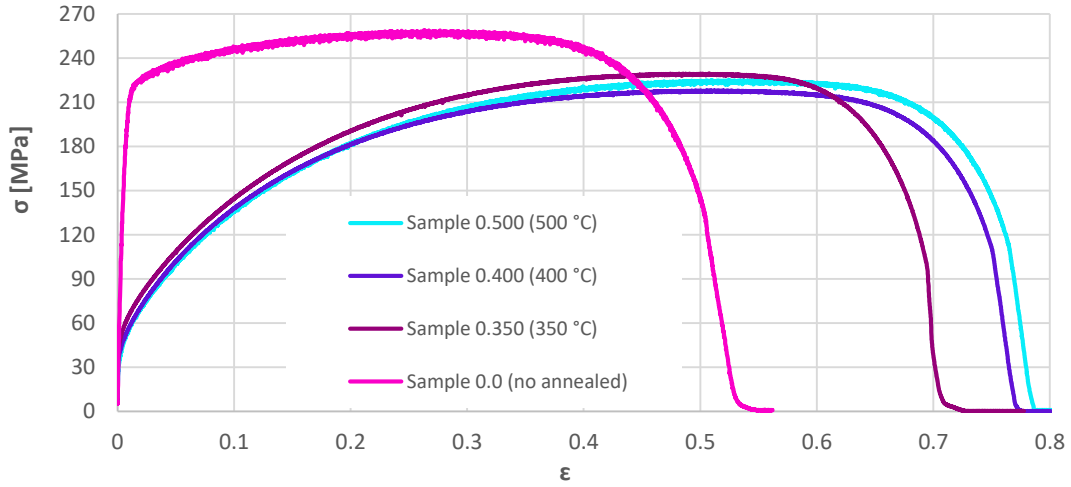
- 500 °C standard LNL annealing treatment
- **Reduce T** → Reduce grain dimension
  → **Increase mechanical properties**
- Test on small sample first

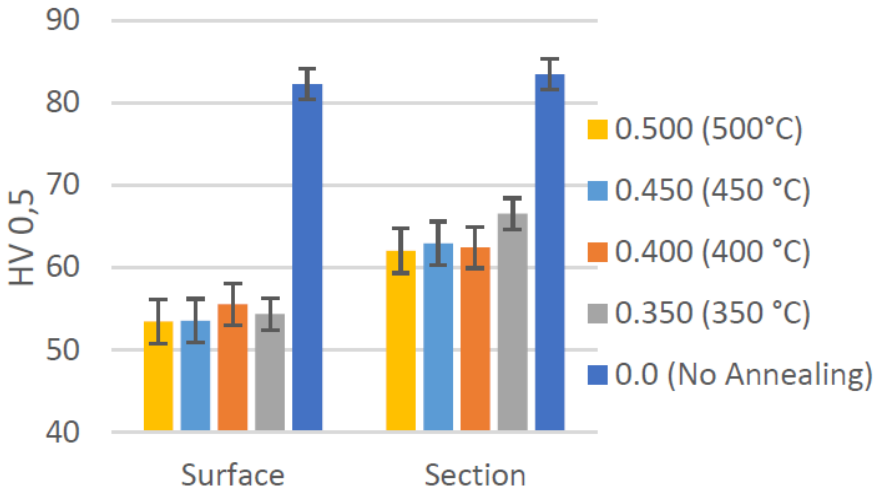




Annealing Temperature



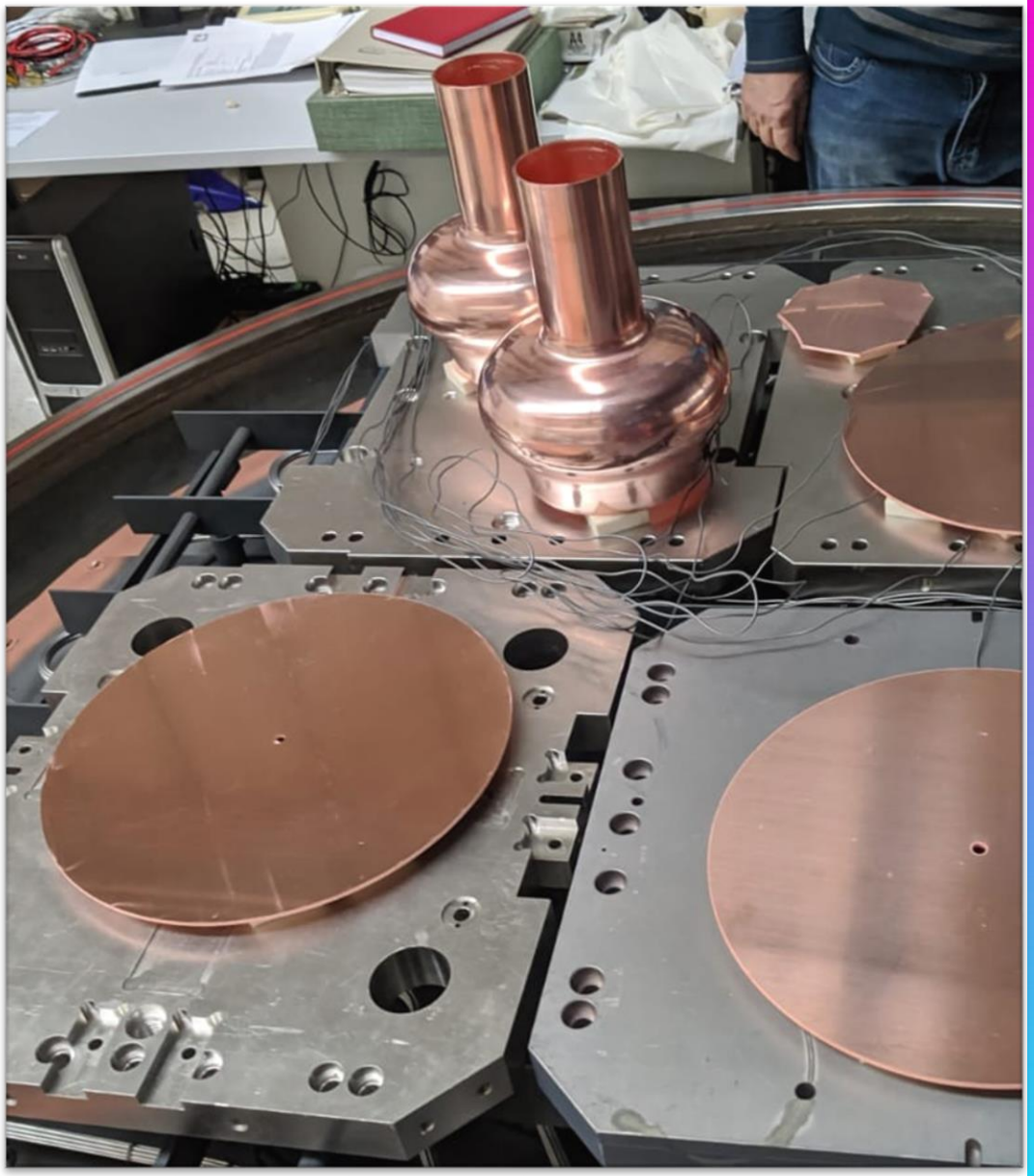




400 °C comparable to 500 °C

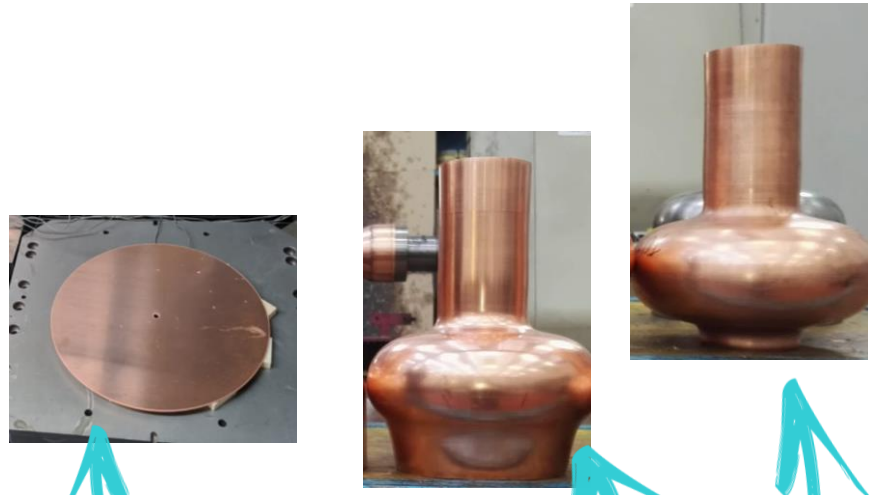
Test on real cavities

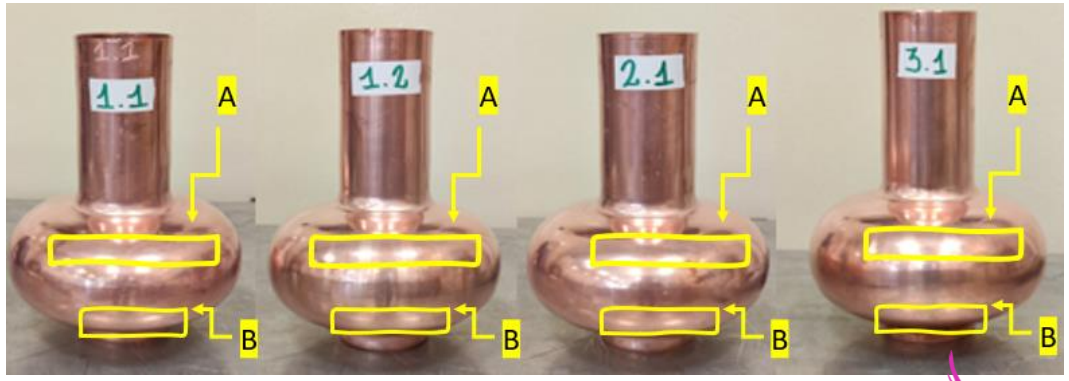
- 18 cavities realized
- 2 annealing T: 500 °C, 400 °C
- No visible difference in forming processes **no intermediate annealing necessary**



Intermediate annealing test

- 4 cavities
- 3 different annealing paths
- 2 cavities for reproducibility check

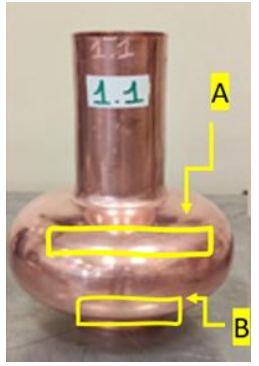


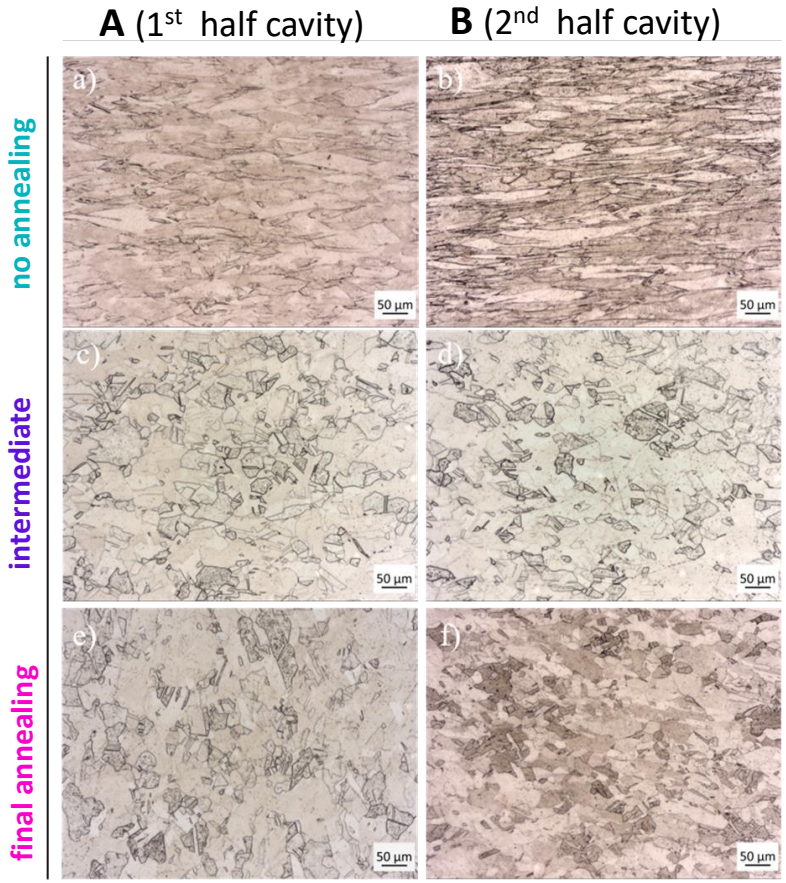


Cavity	Annealing treatments history		
	disk	Intermediate	final
1.1 no annealing	500 °C	-	-
1.2 no annealig	500 °C	-	-
2.1 intermediate	500 °C	500 °C	-
3.1 final annealing	500 °C	-	400 °C

2 samples:
A: 1st half cell
B: 2nd half cell

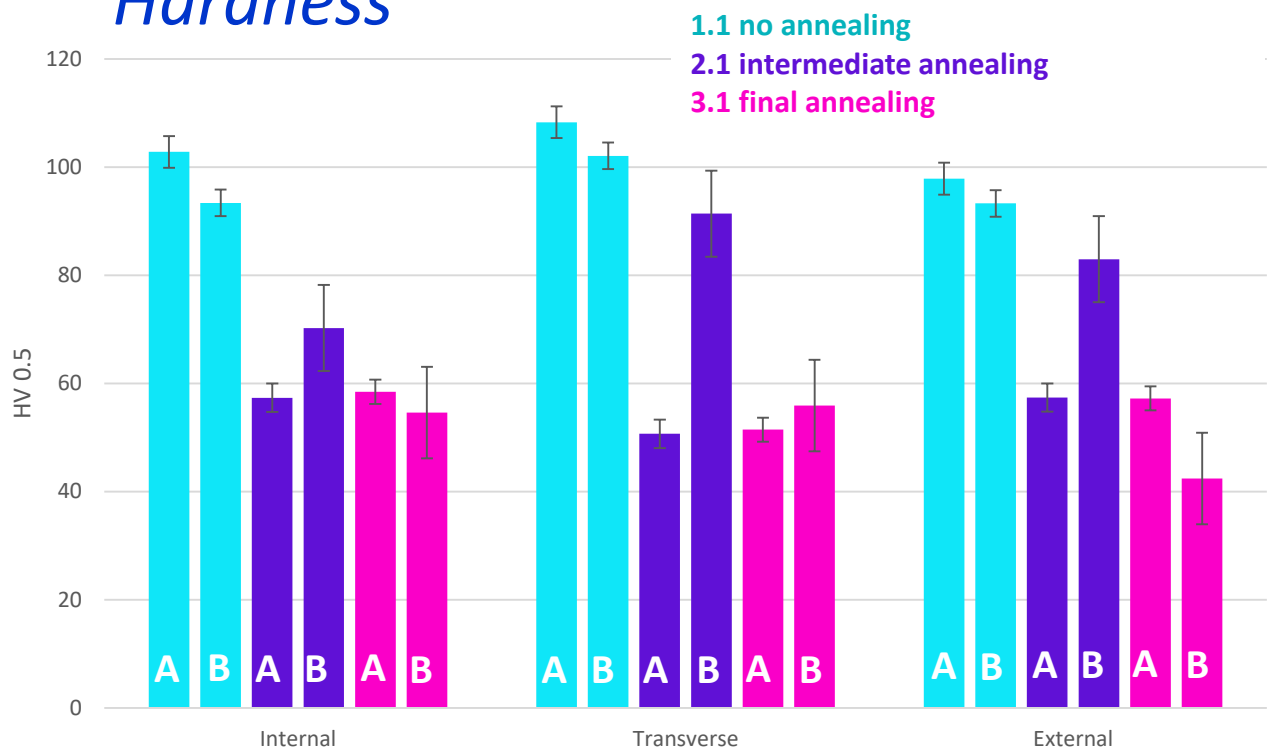
Effect of intermediate annealing





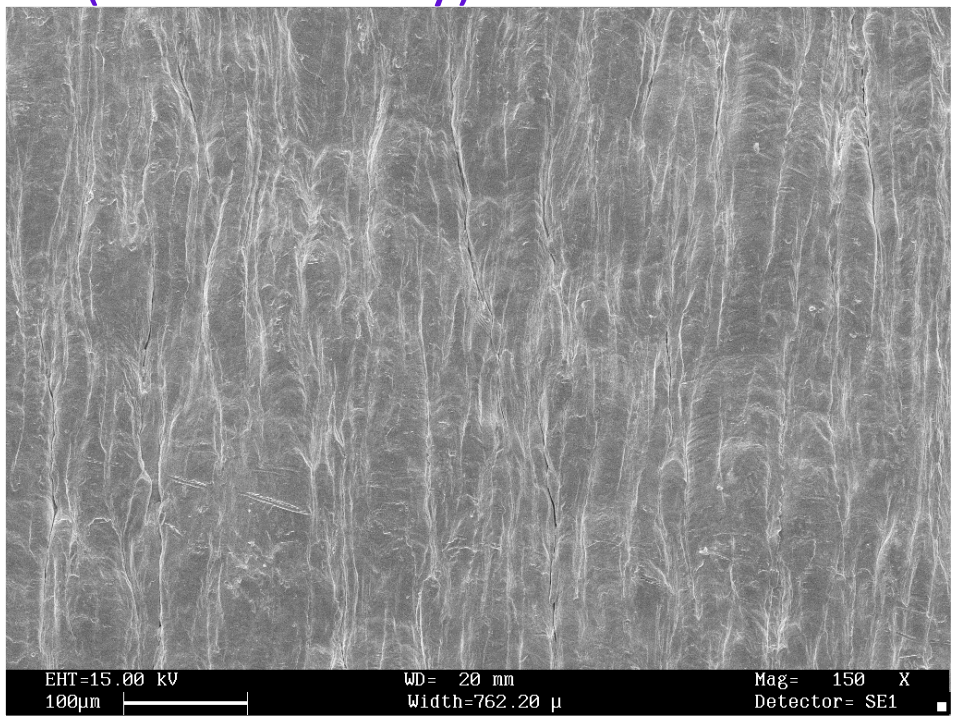
Grain dimension

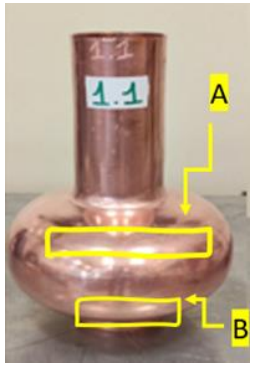
Hardness



Surface defects on 1st and 2nd half cell

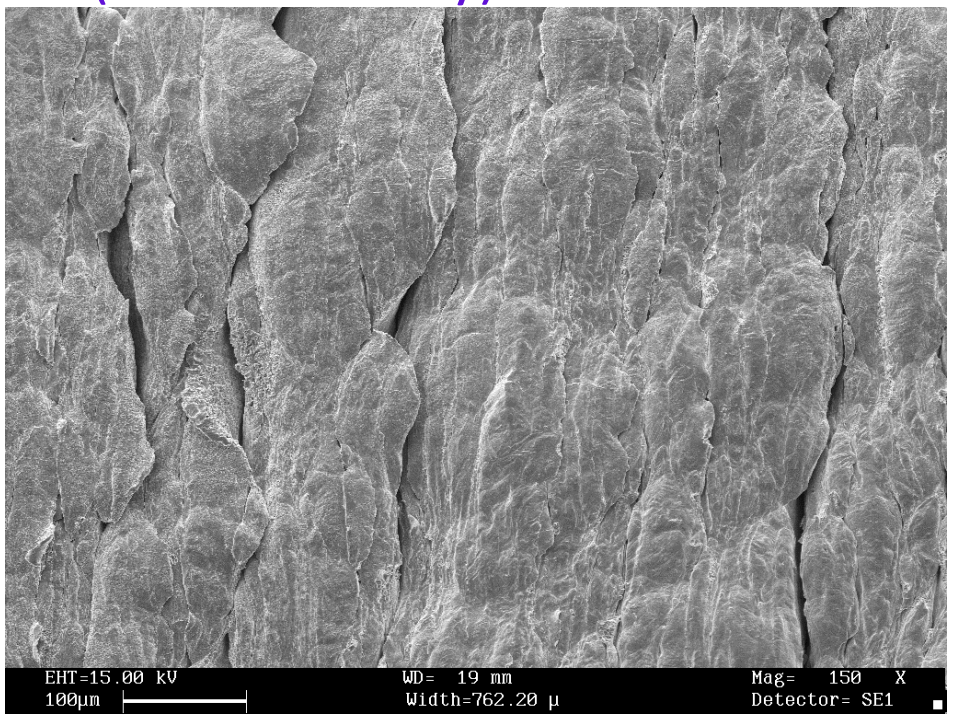
A (1st half cavity)





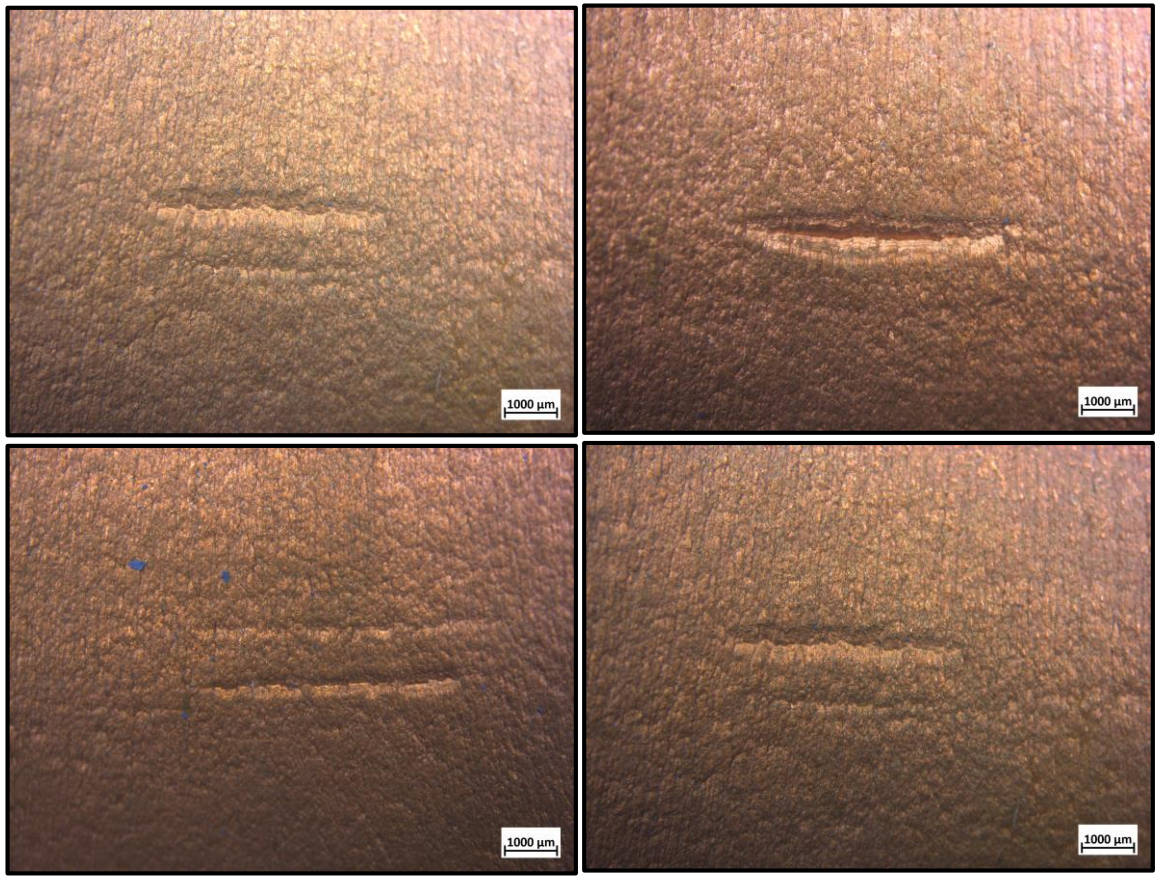
spinning direction

B (2nd half cavity)

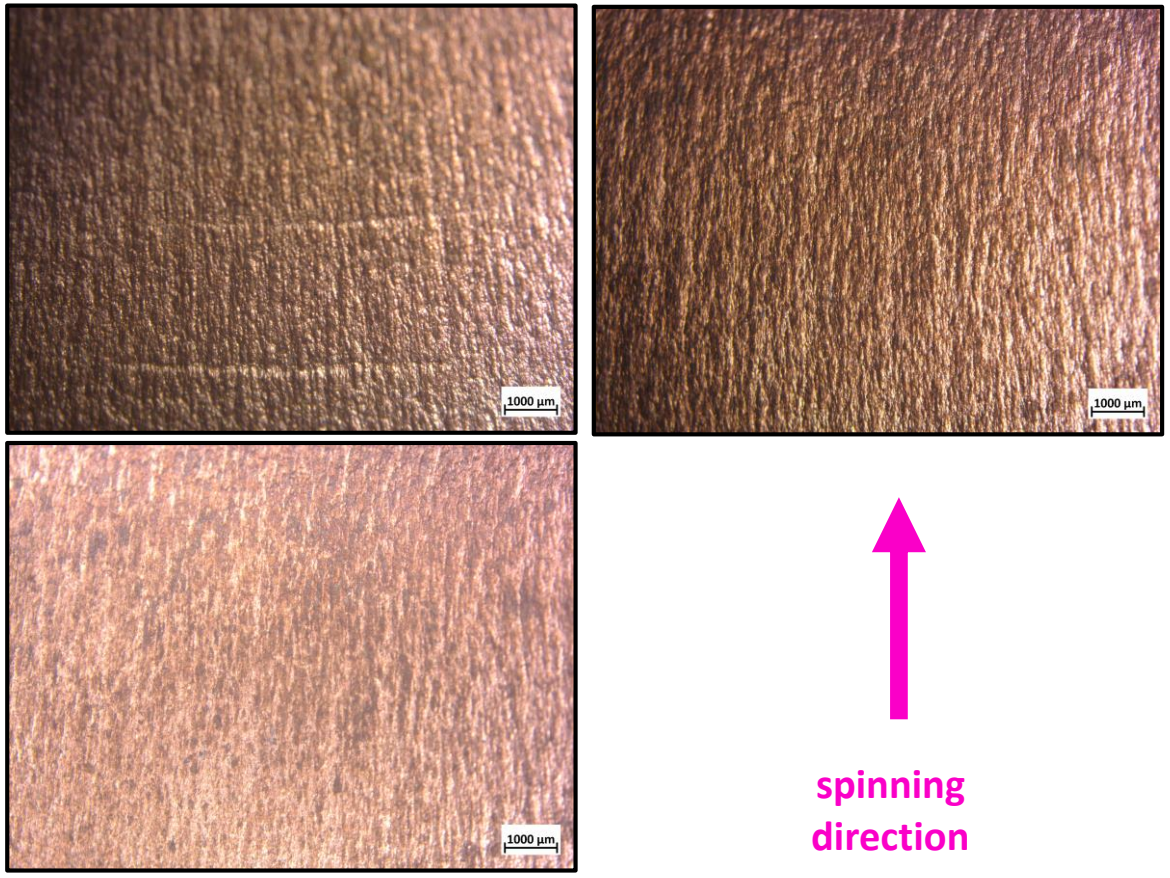


Intermediate annealing reduce defects

1.1 no annealing (iris 2nd half cell)



2.1 intermediate annealing (iris 2nd half cell)



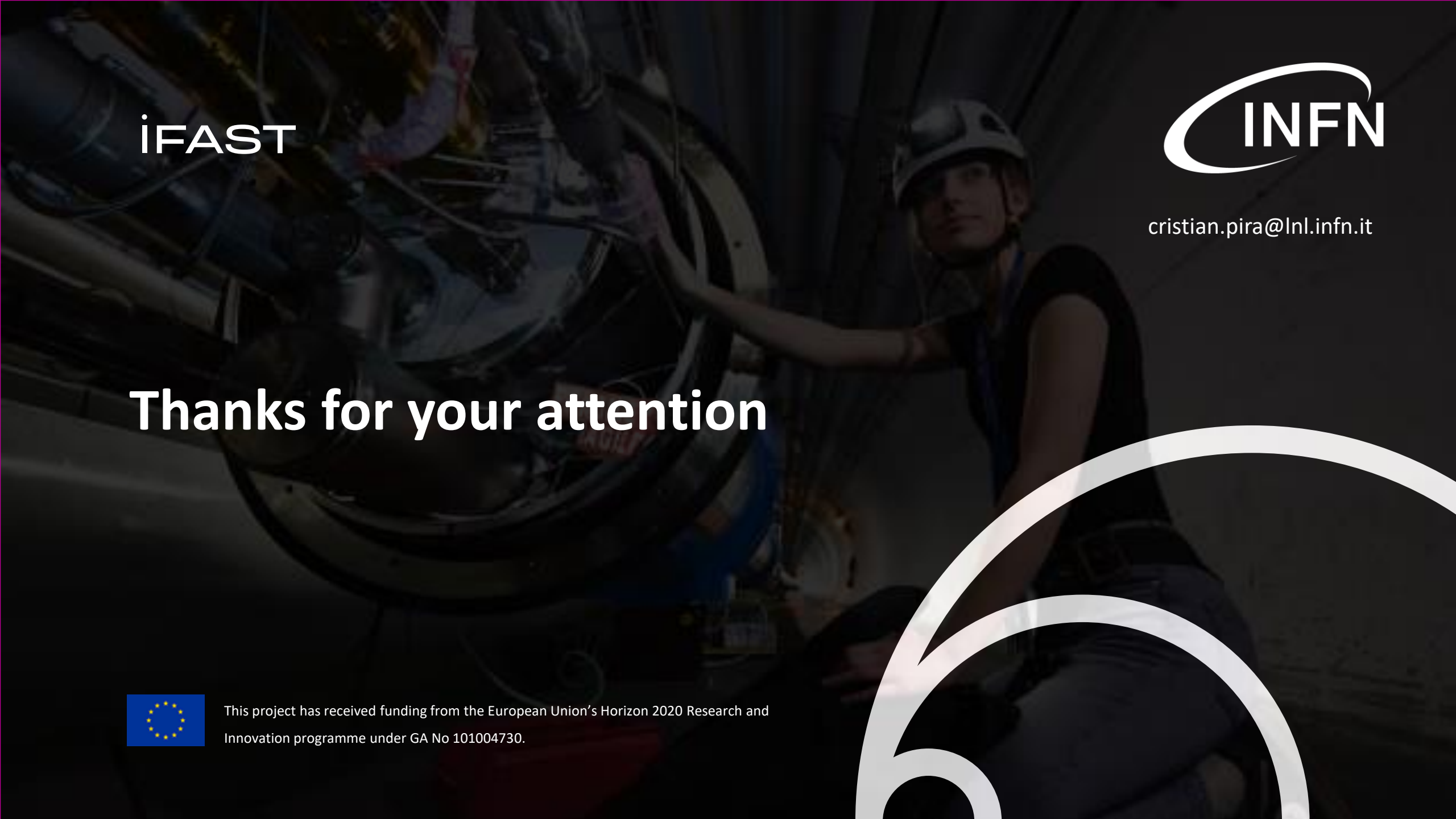
spinning direction

Next steps

→**Optimize CNC program and procedure** for a full cavity

→Buy Cu OFE sheets

→Waiting an answer for PTI-INFN collaboration



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INFN

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Thanks for your attention

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