Electro-Formed Copper Cooling Block for AGIPD @ European XFEL.

Annette Delfs [a,1]

[a] Center for Free-Electron Laser Science, Deutsches Elektronen-Synchrotron (DESY), Hamburg, Germany
[1] corresponding author (annette.delfs@desy.de), for the AGIPD consortium

1) Introduction

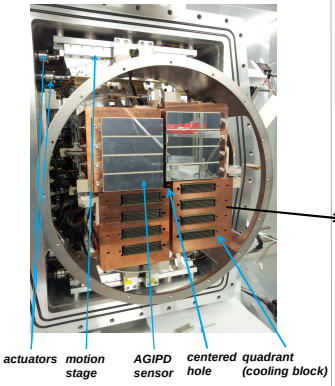
more about AGIPD

Here we present the production of a copper cooling block by electro-forming technology.
The requirements for the cooling block, used for AGIPD @ European XFEL, are:

- 4 AGIPD sensors per cooling block
- total heat load = 200 W
- - 20 °C sensor temperature
- non-uniformity of surface temperature less than 5 K
- coolant = silicone oil
- cooling of electronic components with return flow
- operation in high vacuum

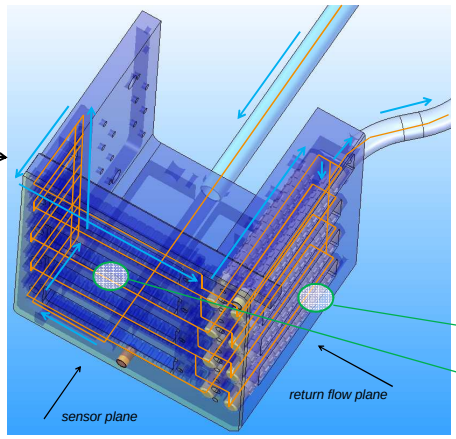
Cooling tests were successfully done on the final detector assembly.

2) What's it all about?



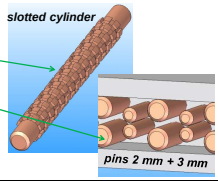
4 quadrants, independently moveable horizontally and vertically to achieve centered holes of □ 0 - 27 mm and slits of 3 mm)
→ 4 cooling circuits required

3) How does the coolant flow? And for what reason?

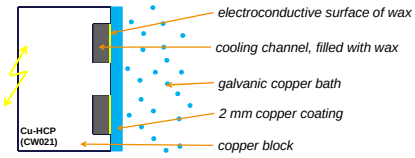


blue = flow direction of coolant (entry temp. = - 60 °C)
orange = cooling channels

For optimal cooling efficiency turbulences must be generated.
Sensitive areas are:
- sensor plane
- return flow plane



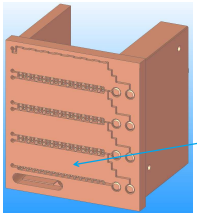
4) Principle of electro-forming [1]

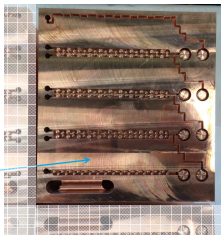


How does it work?

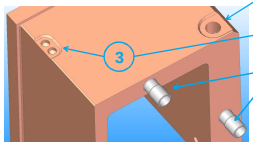
1. Fill all cavities with wax.
2. Pickle surface (acid cleaning).
3. Make surface of wax electrically conducting with graphite.
4. Put cooling block into galvanic bath for a couple of days. (Deposit is approximately 20 – 25 µm/h of copper.)
5. After electro-forming is finished warm up cooling block to 180 °C to melt wax out of all cavities. No structural changes in copper at 180 °C.
6. Now final machining (facemilling, bores, cut-outs, …).

5) Pre-production

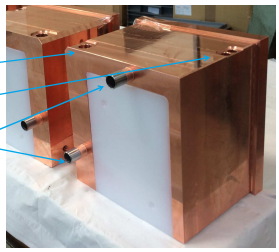




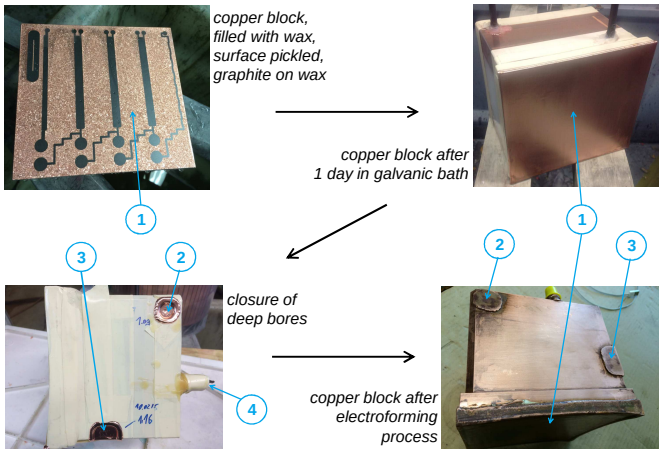
Copper block sensor plane (1) with inserted pins and slotted cylinders; to be covered with copper



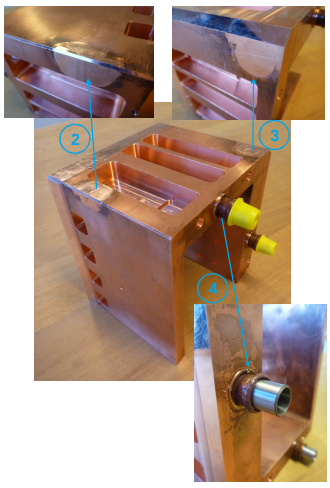
Deep bores (2)(3), to be closed; tube sockets (4), to be sealed vacuum tight



6) Electroforming process



7) Final machining



9) Conclusion

Electro-forming is an excellent technique to produce cavities in copper parts. The essential advantage of electro-forming in comparison to high temperature brazing – the originally planned technique to manufacture the cooling blocks – is a higher process reliability and avoiding disadvantageous structural changes due to high temperatures.

10) References

[1] Galvano-T (D/Windeck)
www.galvano-t.de

11) Acknowledgements

Fa. Körber & Körber (Birkenwerder)
Fa. Galvano-T (Windeck)
DESY-FS-DS group members
DESY-ZM group members

HELMHOLTZ ASSOCIATION

DESY **FS-DS** Detector Group

MEDSI 2016 MECHANICAL ENGINEERING DESIGN OF SYNCHROTRON RADIATION EQUIPMENT AND INSTRUMENTATION