

Particulate Sampling and Analysis during Refurbishment of Prototype European XFEL Cryomodule.



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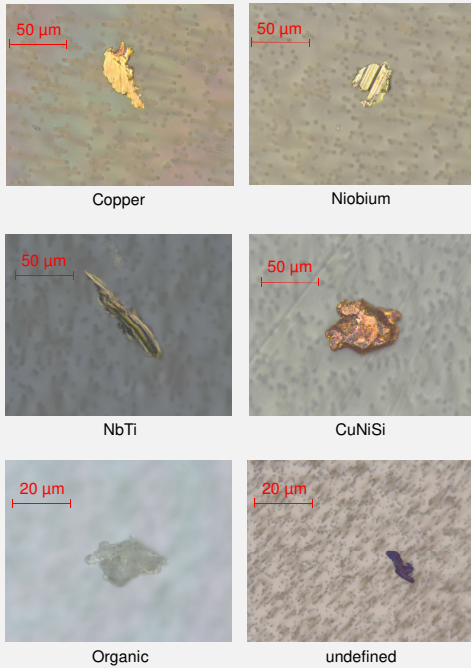
Abstract

The cryomodule PXFEL3_1 is one of three prototype cryomodules for the European XFEL. In preparation of the series module assembly it was used for the qualification of infrastructure and personnel at CEA Saclay. After transport and tests at DESY the cryomodule was stored for several years. Last year we decided to refurbish this module with new cavities for the installation in the FLASH accelerator. During the disassembly of the cavity string in the clean room at DESY we took several particulate samples for analysis. Optical and laser optical microscopy give us an insight on the quantity and type of the particulates. We expect to get hints where the particulates come from and how they are transported through the cavity string during transport and operation.

Particulate Identification

Most materials are of known origin:

- Copper – CF gaskets, Coupler
- Niobium and NbTi – Cavity materials
- CuNiSi – Nuts
- Organic – personnel



Sample Taking and Analysis

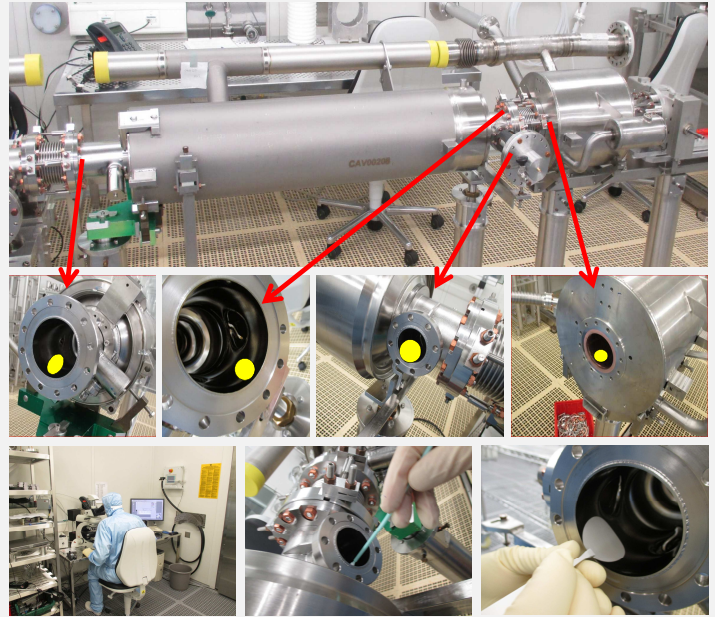
Cavity-string in the DESY SRF clean room. The yellow spots represent the positions where the samples have been taken.

Three flanges on each cavity were probed. Both beam tube flanges (long side (L) and short side (S)) and the main coupler flange (MC).

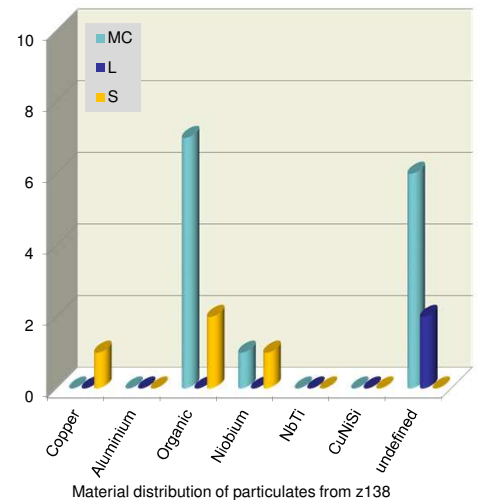
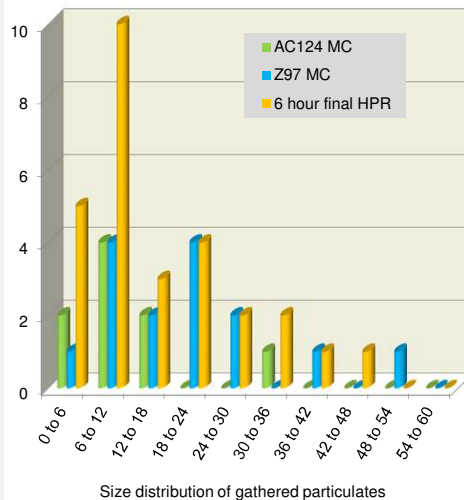
Different methods have been evaluated:

- Swabbing with "cleanfoam swabs"
- Placing and pressing filter discs directly to cavity surface

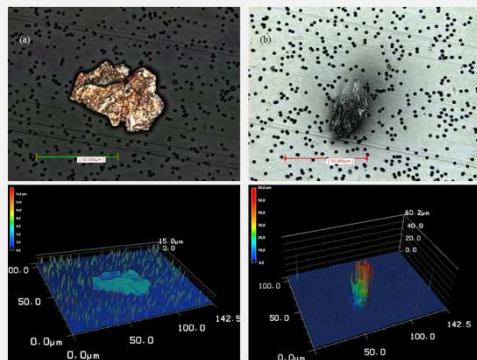
In total 25 samples have been taken and were analysed by optical microscope inside the clean room.



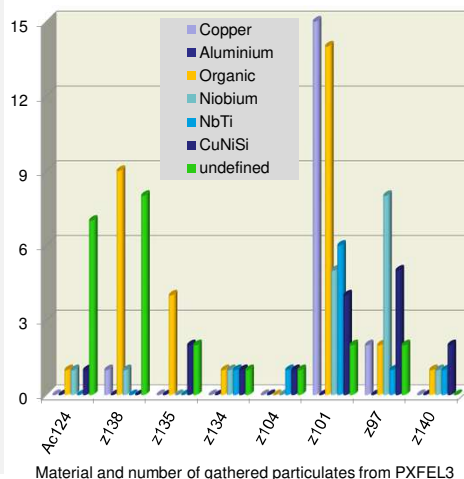
Particulate Counts



Particulate sizing with 3D laser scanning microscope



LSM analysis of (a) a copper and (b) an organic particulate



Conclusion

During the disassembly of PXFEL3_1 we probed a cavity string for the first time for particulate contamination inside the cavities. In total we took samples at 25 spots in the string and analysed the samples. As we expected, the count of particulates is quite low and most of the particulates are of known materials. The 23 particulates of undefined material will be further analysed. A scanning electron microscope (SEM) analysis will be applied and used to determine metallic materials. As the SEM we use has no automated particulate recognition, this method will only be used for selected single particulates, which could not be identified by the optical microscope.

For the next disassembly process we aim for an improved probing method. Mainly we want to make sure that we transfer nearly every particulate on the surface to the sample.

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