

Comments on Electropolishing at Ettore Zanon SpA at the end of EXFEL production



M. Rizzi*, G. Corniani - Ettore Zanon SpA, Schio, Italy ;
A. Matheisen - DESY, Hamburg, Germany;
P. Michelato, INFN Milano - LASA, Segrate, Italy
*mrizzi@zanon.com



INTRODUCTION

In 2013 a new horizontal Electropolishing facility was developed and implemented by Ettore Zanon SpA

More than 300 cavities have been treated by electropolishing for the preparation of cavities for EXFEL series production at EZ. Electro polishing was in use there for two major applications: bulk removal during series production and recovering of cavities with surface defects. For the LCLSII project the EP system will be updated.

EP TREATMENT

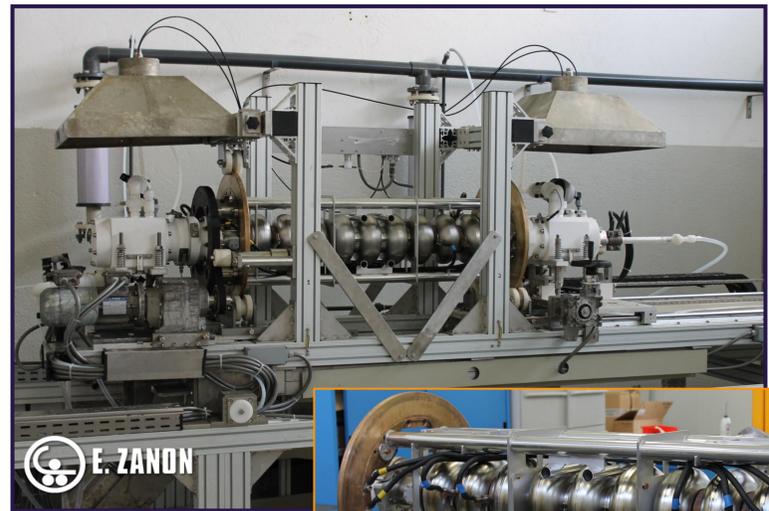
BCP flash production scheme for EXFEL:

140 μm EP as first cleaning + 10 μm BCP after He tank integration

Main Parameters for EXFEL:

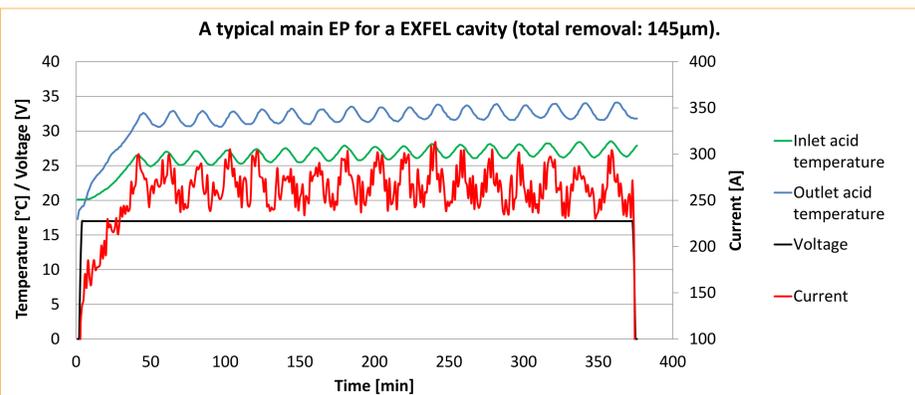
- Voltage : 17 V
- Average current value: ≈ 270 A
- Average acid temperature value: ≈ 32 $^{\circ}\text{C}$
- Acid flowrate: 10 l/min
- Automatic current and temperature control
- Automatic movements and rotation
- Sensors for: temperature, pressure, flowrate, acid level
- Personnel and explosion safety \rightarrow H₂ and HF control
- Removal rate: ≈ 0.4 $\mu\text{m}/\text{min}$
- Main EP completed in 6 hours

EP FACILITY



The facility can perform **five bulk treatments per week** (140 μm each) over a long period.

A one/two days maintenance every month is necessary to assure stable quality.

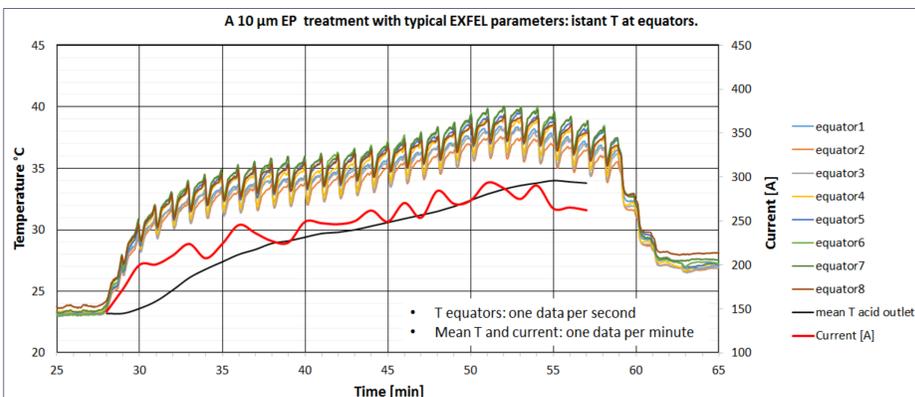


A typical EP treatment. The oscillating value is caused by the cooling system, that works as ON/OFF. Data taken each minute.

Average removal can be estimated from cavity weighing and from current integration:

$$\mu\text{m} = \sum_{t=0}^{t=t_{EP}} (1.484 \cdot 10^{-3} \cdot I \cdot \Delta t)$$

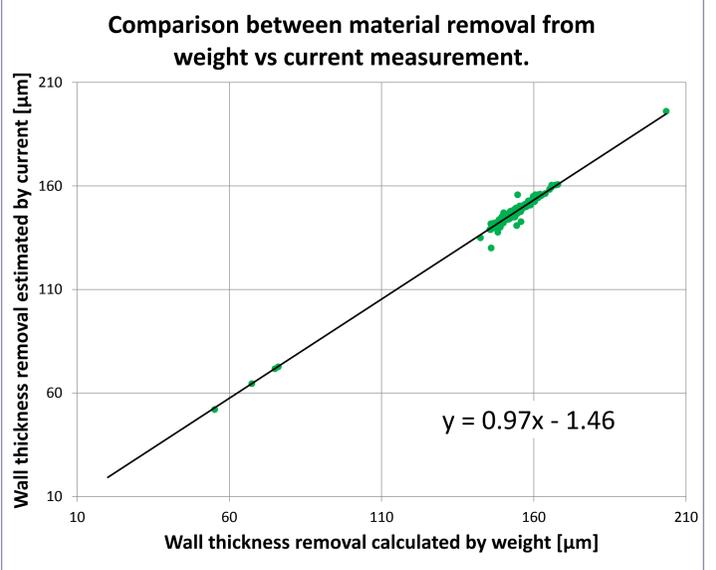
Data are in good agreement.



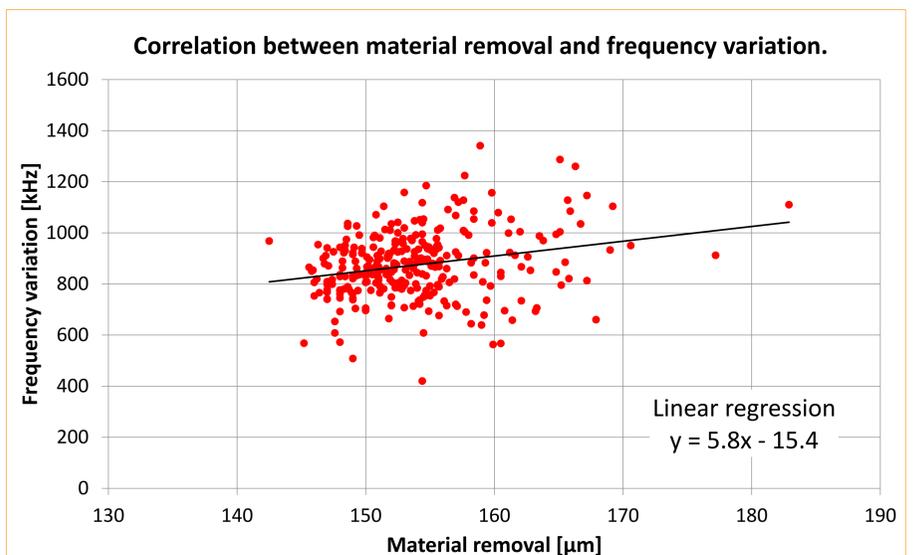
Required for new LCLSII project!

Here a test with the new **wireless thermocouples** that can be installed directly on **cavity surface, at equators or irises.**

Almost instantaneous local temperature!



RESULTS AND CONCLUSIONS



The **material removed by EP** causes a **frequency variation** in the cavity.

Correlation depends on:

- differential removal iris/equator
- EP facility and parameters.

Data are quite scattered, but:

- mean value used for cavity composition: 1 $\mu\text{m} \approx 6$ kHz
- specification requirements fulfilled.

According to Desy request, several cavities did a longer EP to verify if a **higher surface removal** could improve **Eacc performances**. Data collected from 300 cavities show no correlation.

- The completion of EXFEL production has shown that the facility is reliable.
- More investigation may be interesting to understand frequency variation behavior.
- As long as the minimum 140 μm removal is guaranteed, cavities electropolished with this facility perform well during vertical test, above requested goal (23 MV/m).
- Facing the new production of cavities for the upgrading of LCLSII, the process will be modified and verified according to specification of Jefferson Lab.

