

PLASMAS DE ALTA DENSIDAD



AL RESCATE DE LAS PARTÍCULAS DEL HAZ

Esteban Villegas Dominguez
Daniel Montesinos Capacete
Lucia Lain Amador

Accelerator requirements

Ultra high vacuum (UHV)

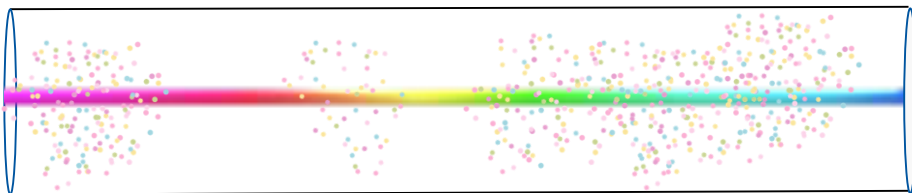
Necessity for **low pressures** in order not to interact with the beam.

-Low outgassing materials:

Avoid the release of gas from the substrate.

- Chemical pump:

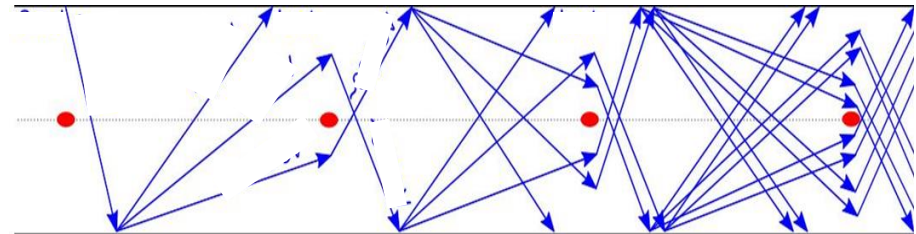
Pump residual gas molecules.



Electron cloud mitigation

Disturbed beam due to presence of electrons.

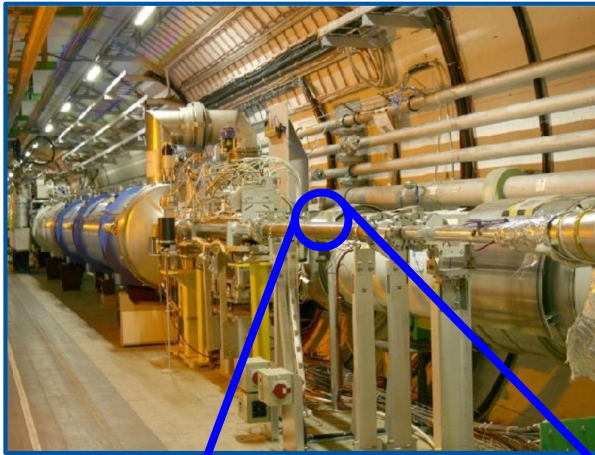
-Beam **particles** may **impinge** the vacuum chamber wall, **releasing electrons**. They **will hit again** in an ongoing process, generating the electron cloud.



Non-Evaporable Getters

NEG

← Zirconium + Vanadium + Titanium



40
Zr
Zirconium
91.224

2
8
18
10
2

25-40%

23
V
Vanadium
50.9415

2
8
11
2

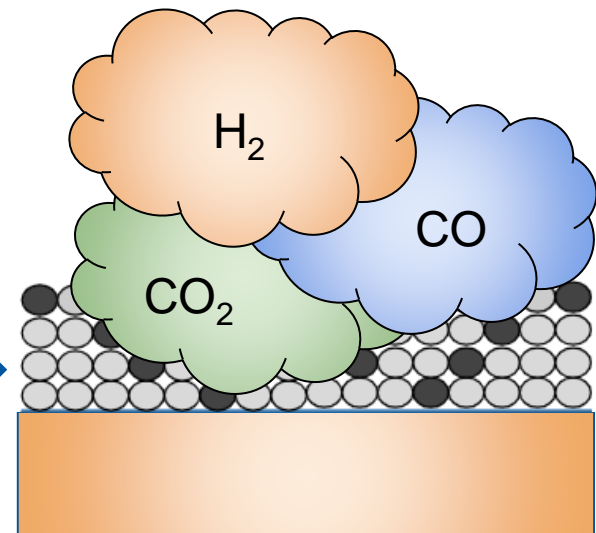
25-40%

22
Ti
Titanium
47.867

2
8
10
2

25-40%

Thermal
Activation



1 - 1,5µm

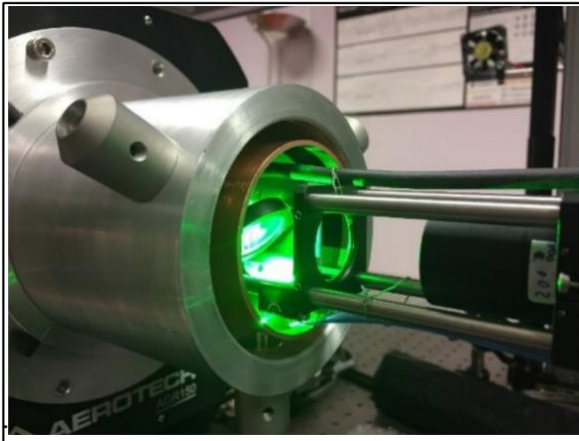
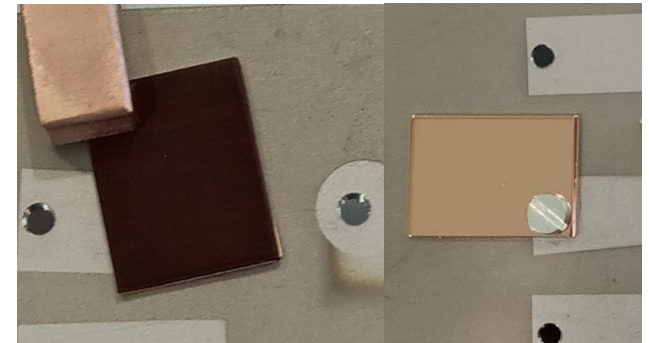
Objectives

Study the **NEG coating** on different materials: smooth and rough copper. The **Rough Cu**, made by **laser treatment**, will be the main subject to analyse due to its **unknown properties**.

- Perform the coating on the samples.
- Characterize the coated samples.

Rough Cu

Polished Cu



Laser treatment

University of Dundee, Scotland

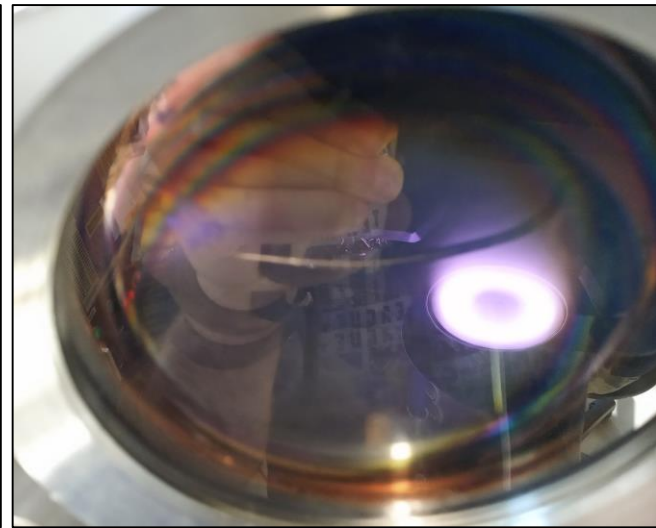
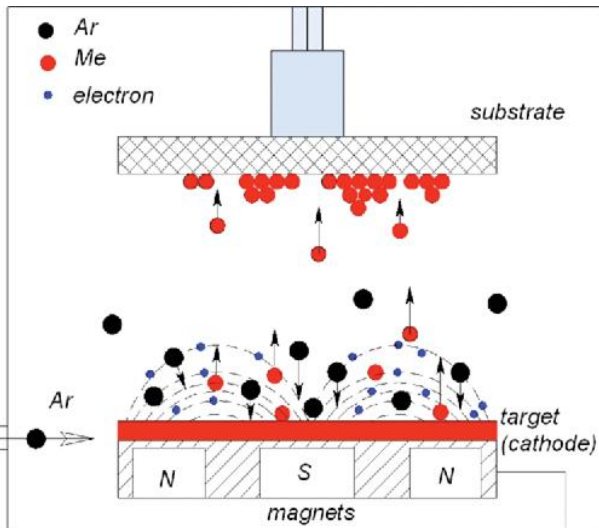
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1067 (2018) 082017



Plasma Magnetron Sputtering

-Nanotechnology coating method.

Ultra high vacuum process where an ionised noble gas (**plasma**) **bombards** a **cathode**, causing it to **sputter** towards the substrate creating a thin film coating.



Coating analysis

TiZrV
(NEG)

Composition

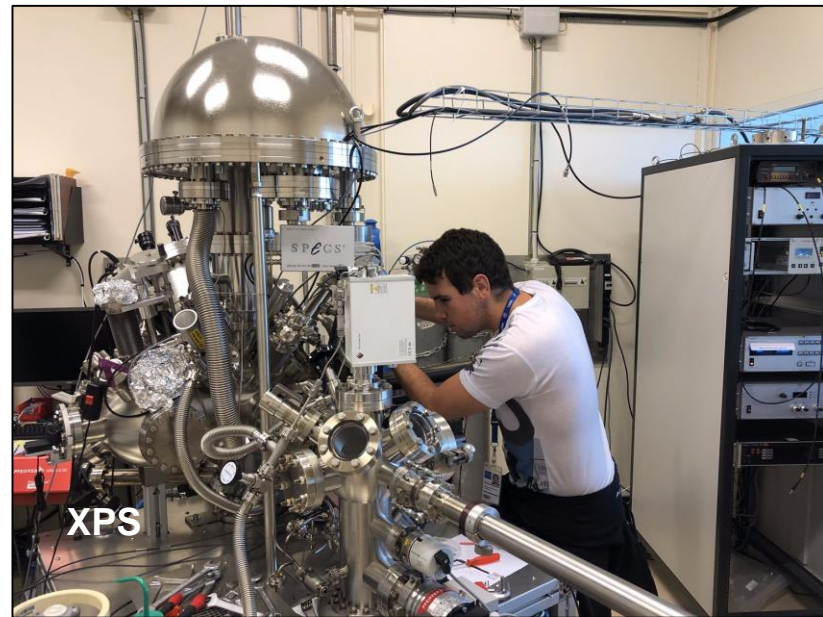
X-Ray Fluorescence
Analysis (**XRF**)

Thickness

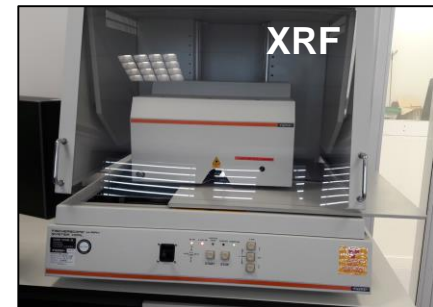
Morphology

Optical microscopy
Secondary electron microscopy (**SEM**)

Activation — X-Ray Photoemission Spectroscopy (**XPS**)



XPS



XRF



SEM

Coating composition

Measured by **XRF**

NEG

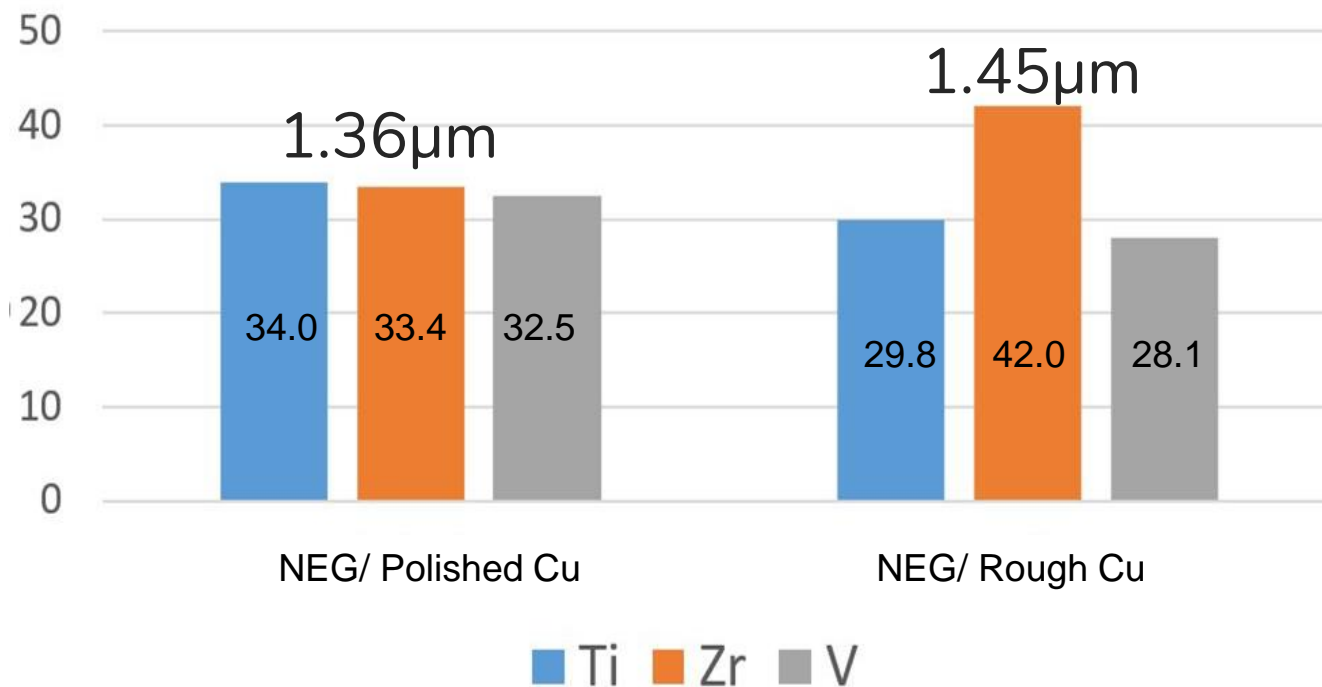


Zirconium + Vanadium + Titanium

~25-40%

~25-40%

~25-40%



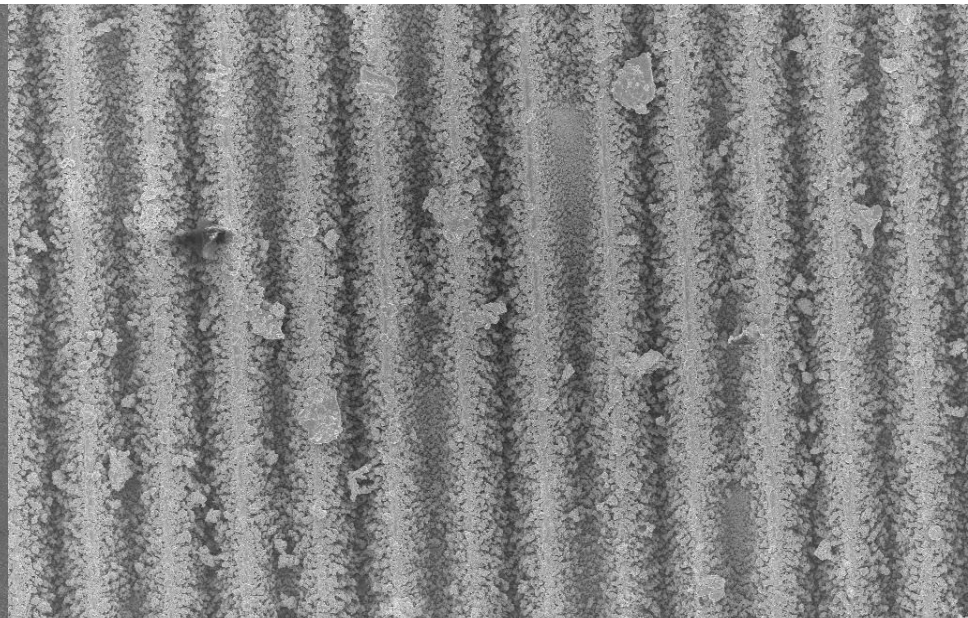
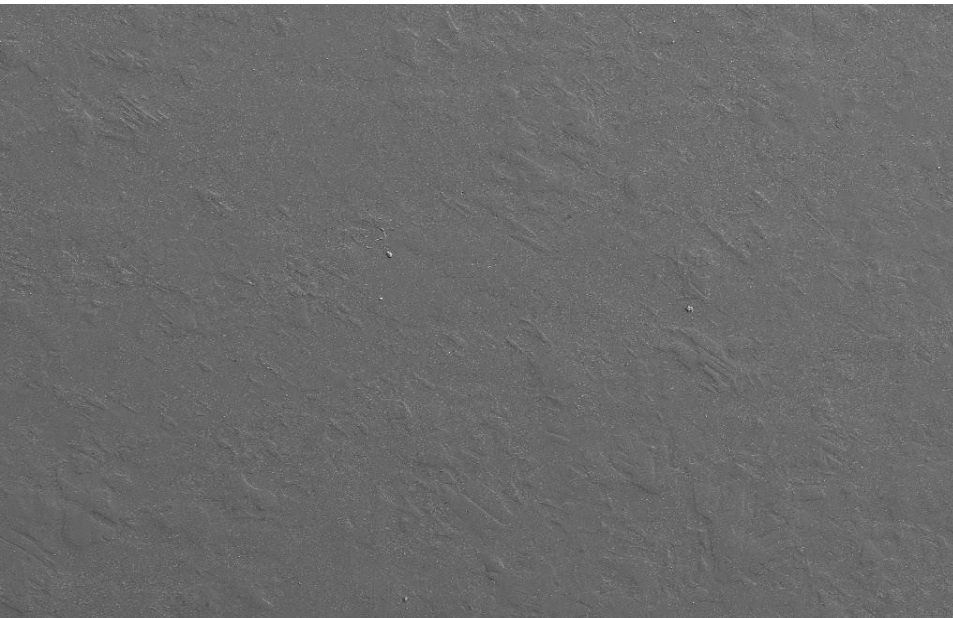
Microscopy Analysis


Morphology of the material


NEG/Polished Cu

Mag 200

NEG/Rough Cu



20 μ m EHT = 10.00 kV
WD = 4.6 mm Sample ID = Cu_SUBU_
Signal A = SE2 Date :4 Oct 2019
Mag = 200 X 

20 μ m EHT = 5.00 kV
WD = 3.7 mm Sample ID = LESS_
Signal A = InLens Date :4 Oct 2019
Mag = 200 X 

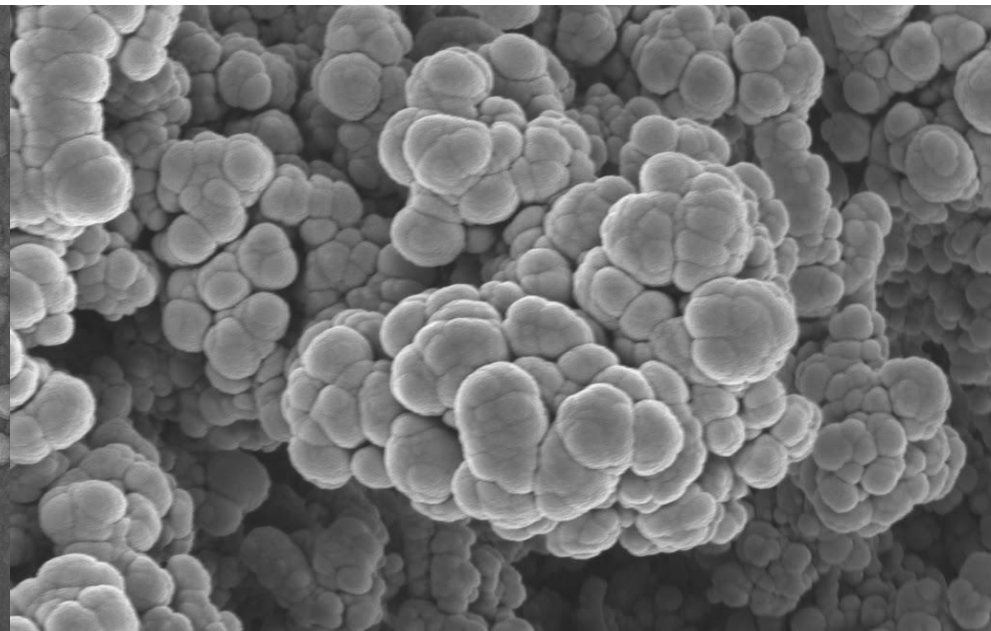
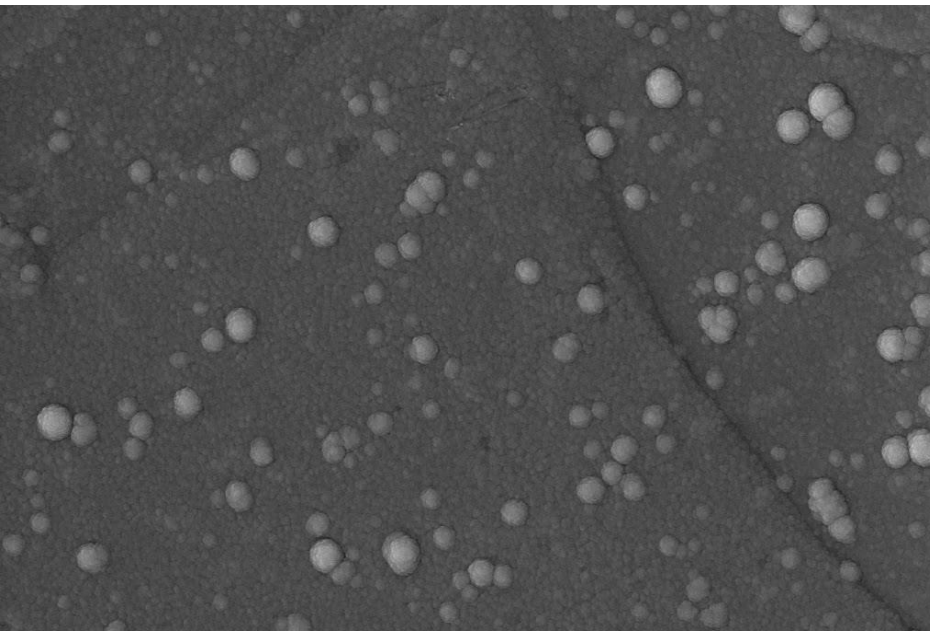
Microscopy Analysis


Morphology of the material


NEG/Polished Cu

Mag 10.000

NEG/Rough Cu

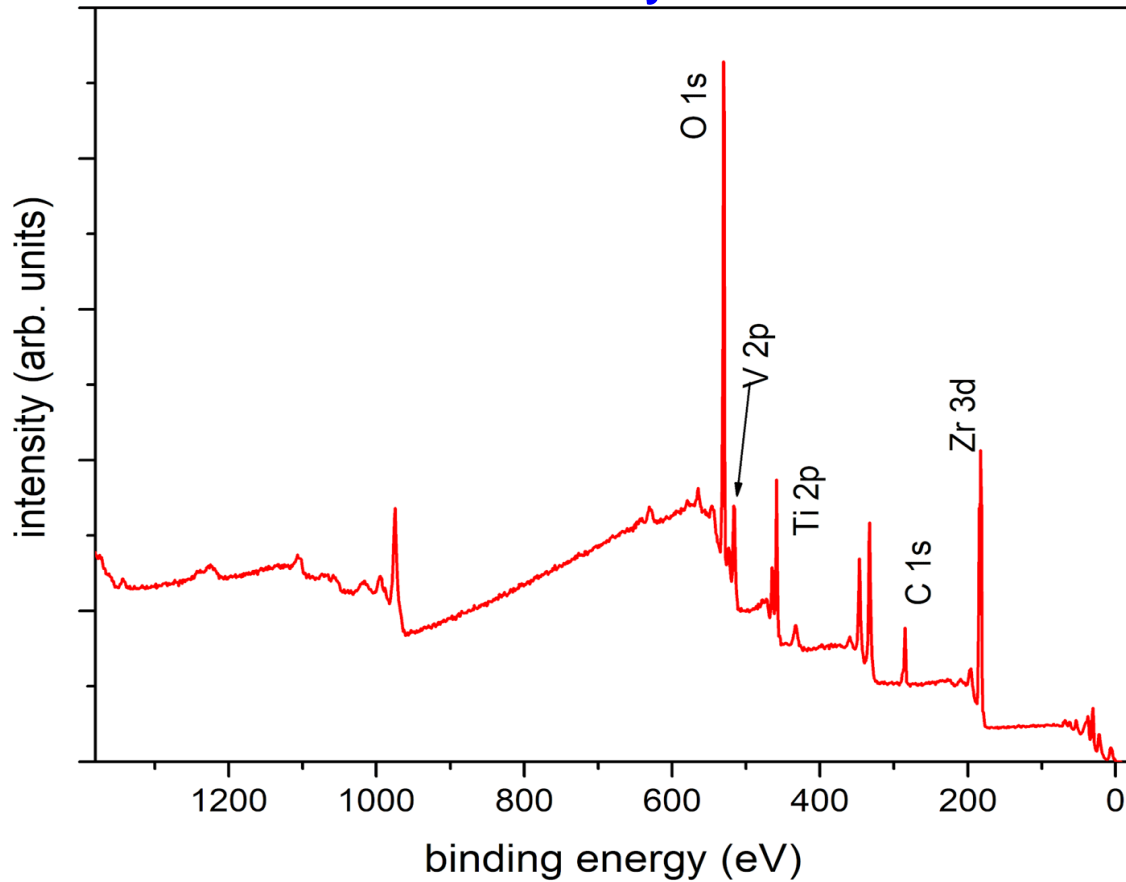


1 μ m
EHT = 10.00 kV
WD = 4.6 mm
Signal A = InLens
Sample ID = Cu_SUBU_
Date :4 Oct 2019
Mag = 10.00 K X


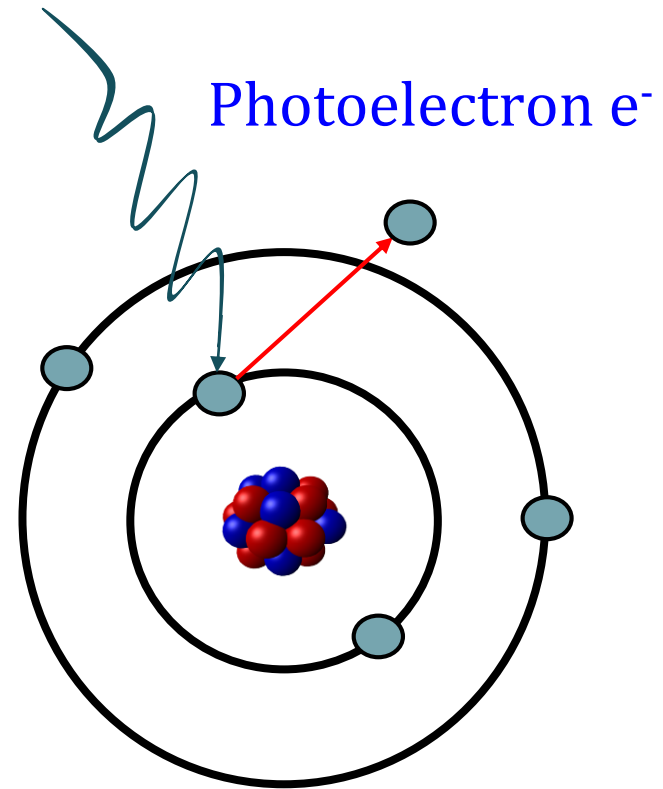
1 μ m
EHT = 5.00 kV
WD = 3.7 mm
Signal A = InLens
Sample ID = LESS_
Date :4 Oct 2019
Mag = 10.00 K X


NEG Activation

Measured by **XPS**

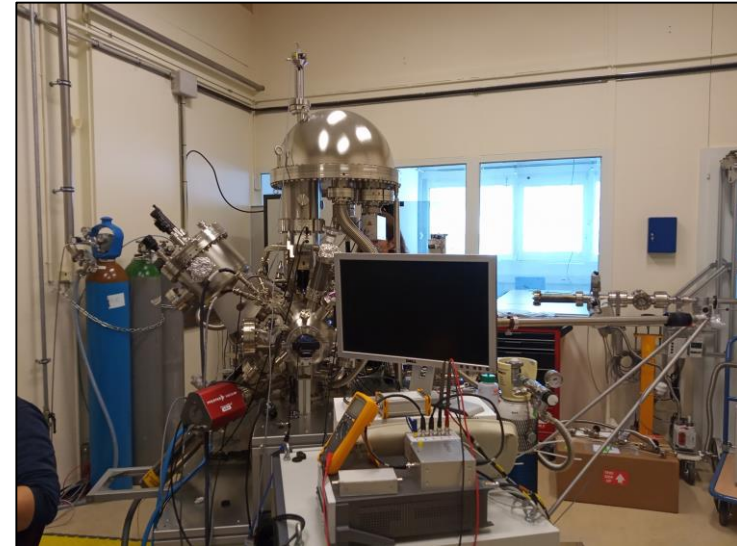
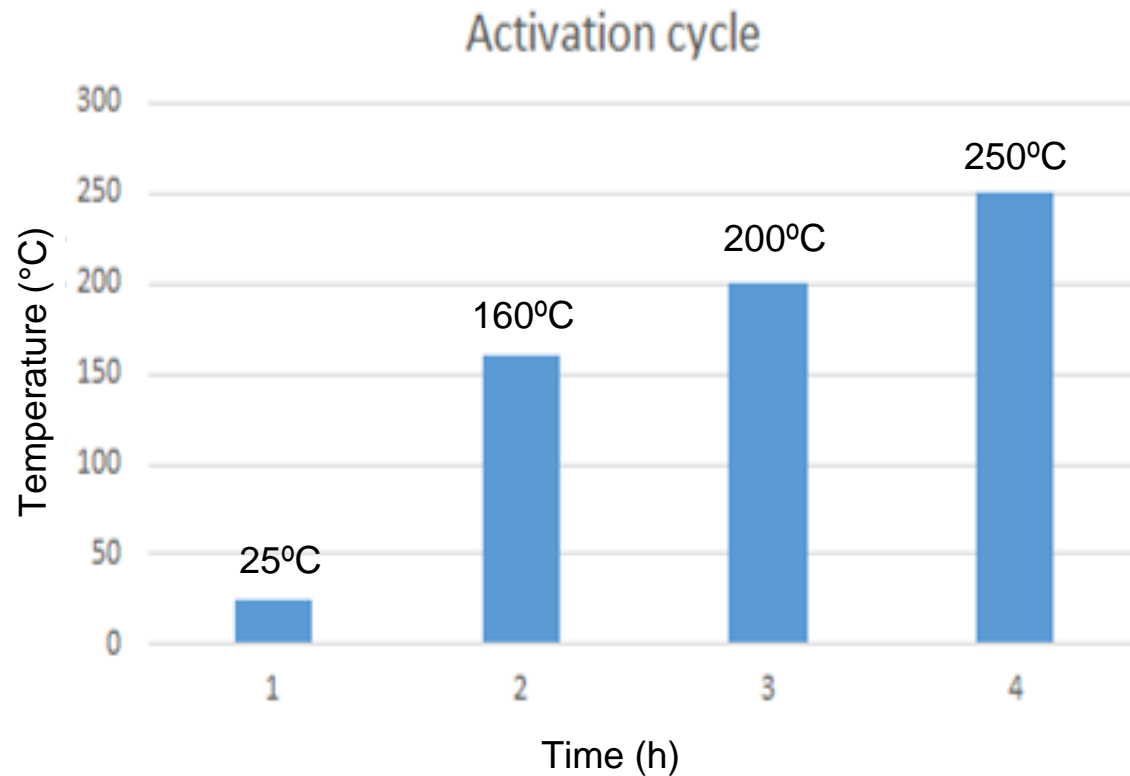


X-Ray

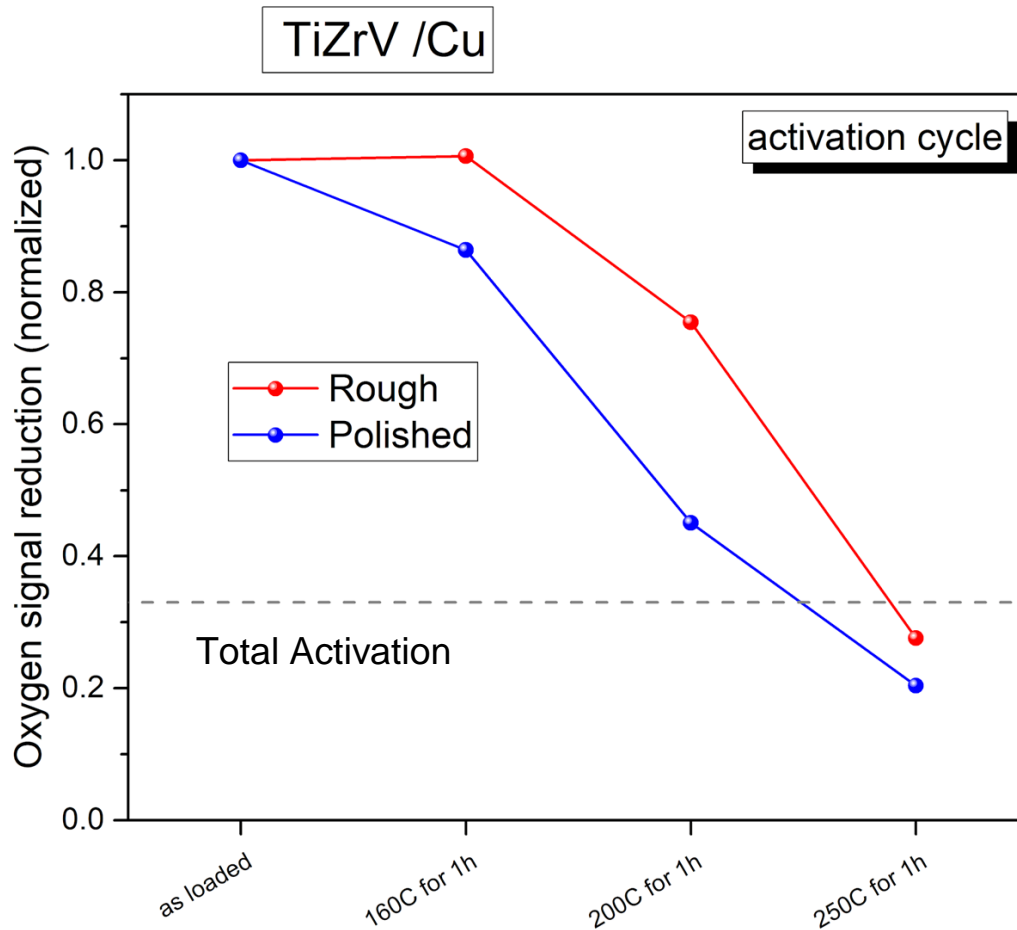


NEG Activation

Monitor oxygen peak during thermal activation



NEG Activation

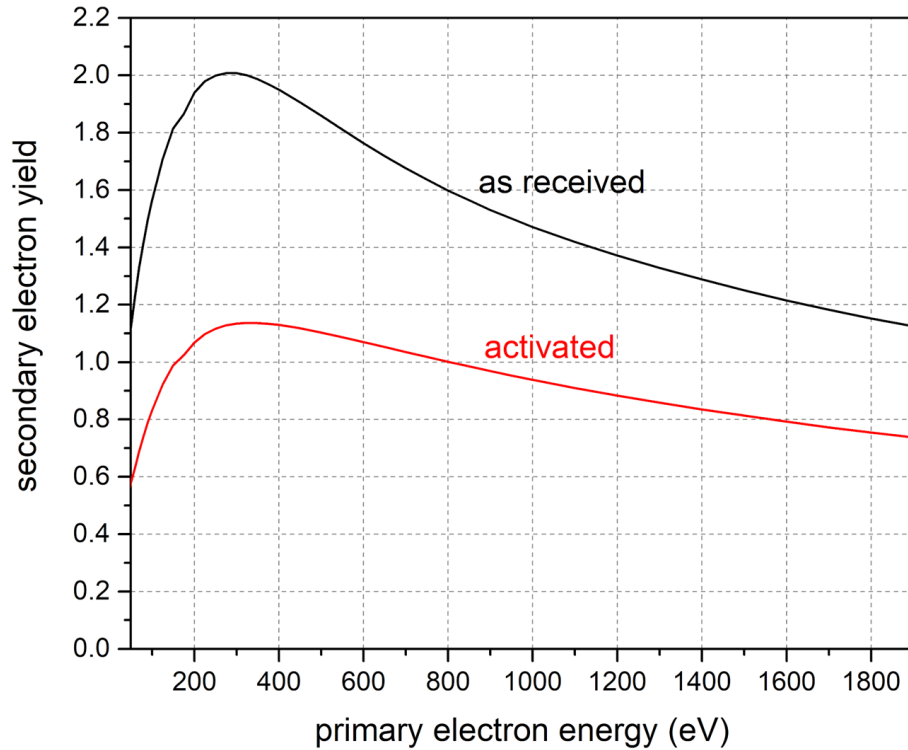


Both samples
activated at 250°C

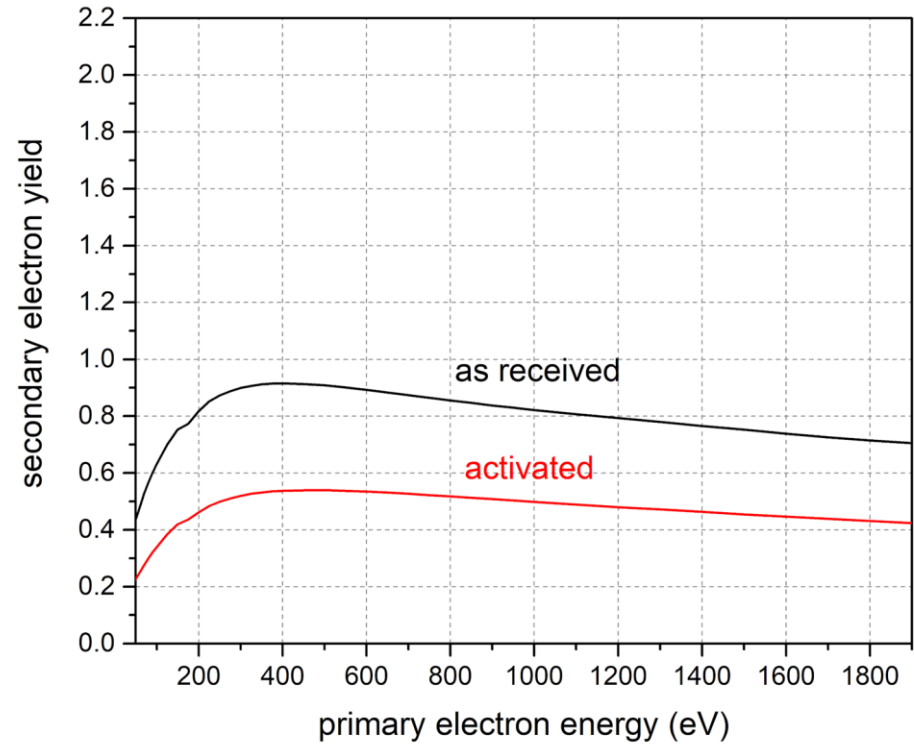
Faster activation
for the smooth
sample

Secondary electron yield

NEG/Cu polished



NEG/Cu laser treated



Conclusions

Both samples activated correctly. In addition, the rough one gives a lower secondary electron yield.



HSSIP
High-School Students
Internship Programme

We would also want to say it has been an amazing experience. We have learnt a lot about how people work at CERN. We have notice the importance of cooperation between each other and team working.



$\frac{\text{sen } Q}{\text{cos } Q} = \tan Q = \text{thank u} = \text{Thank you}$
(READ IN ENGLISH)

