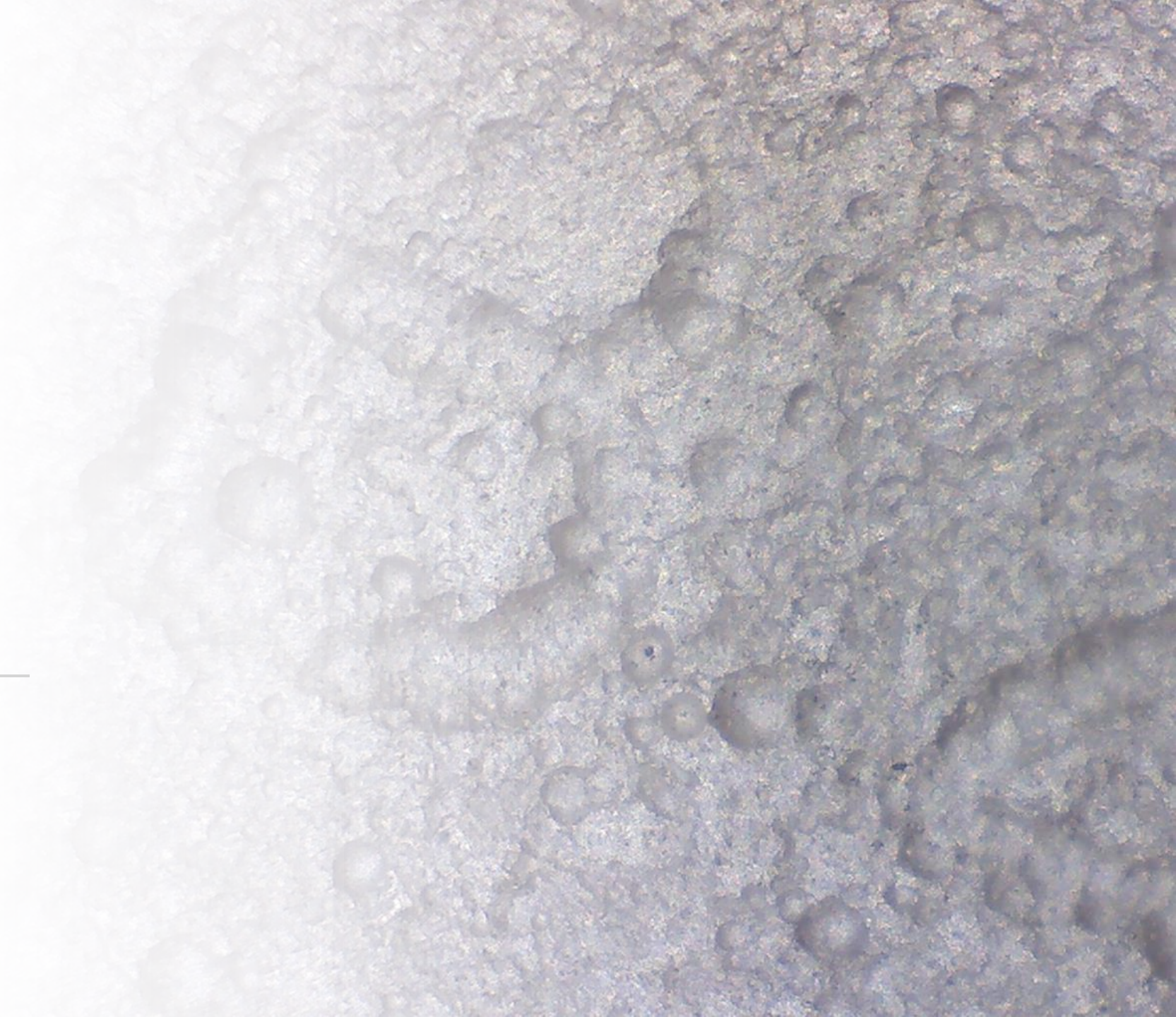




Surface treatments at CERN

Leonel Ferreira_ TE/VSC

3rd PBC technology mini workshop,
CERN 6th April 2022



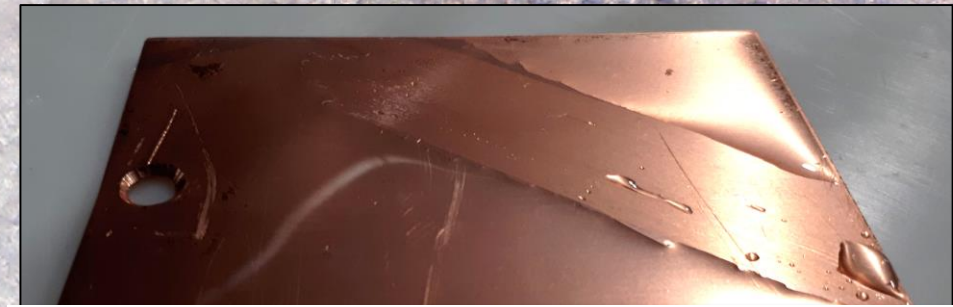
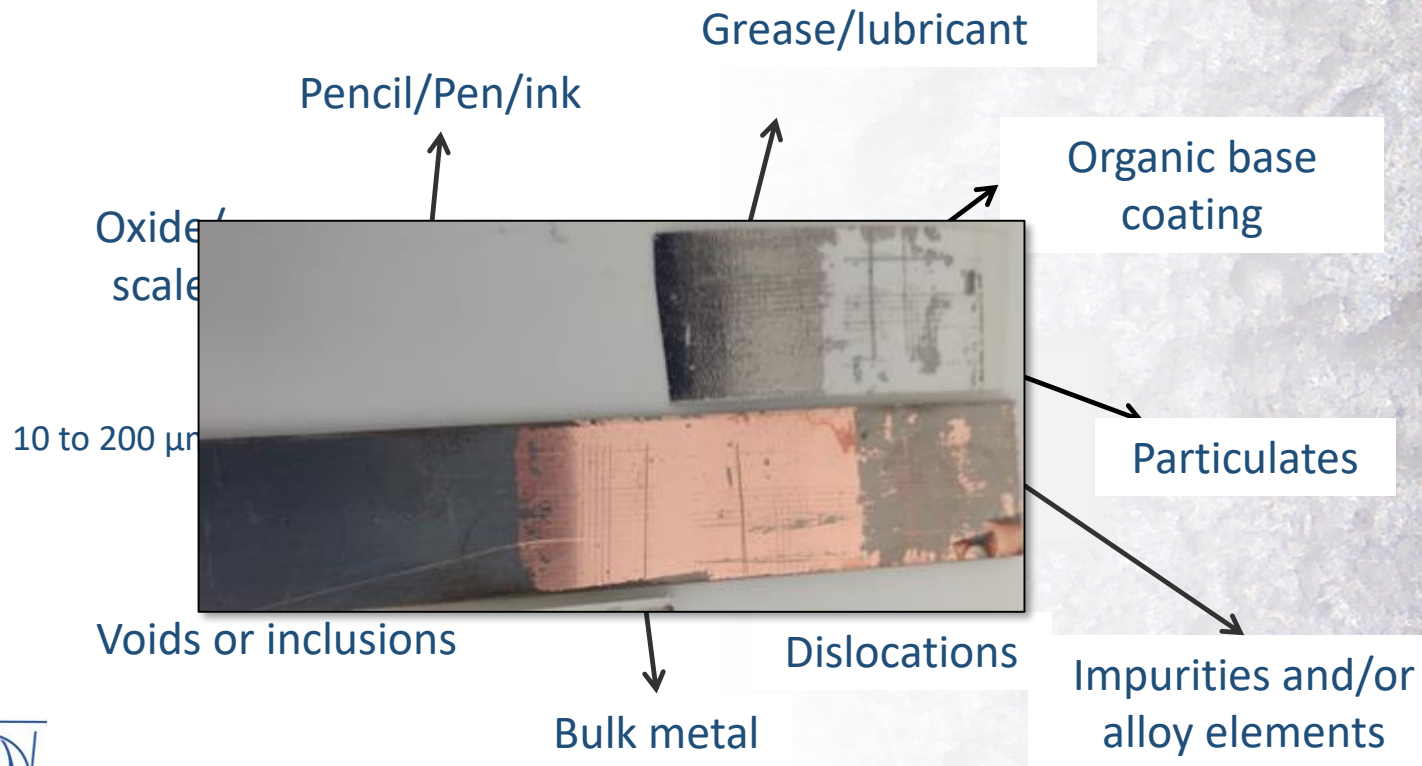


Content

- Cleaning and cleanliness assessment
 - Electroplating
 - Electroforming
-

Cleaning and cleanliness assessment

Clean surface: What is clean?



Degreasing:

- removal of organic based contaminations.
 - water and solvent based solutions

Pickling:

- removal of inorganic based contaminations.
 - Acid/alkaline solutions

Etching/Polishing:

- removal of bulk metal.
 - Acid/alkaline solutions



Cleaning and cleanliness assessment

Organic based contaminants: wax, grease, oil, ink...



1.7 m³ capacity



11 m³ capacity



4 m³ capacity

Organic solvent based degreasing

Degreasing with alkaline water based degreasing

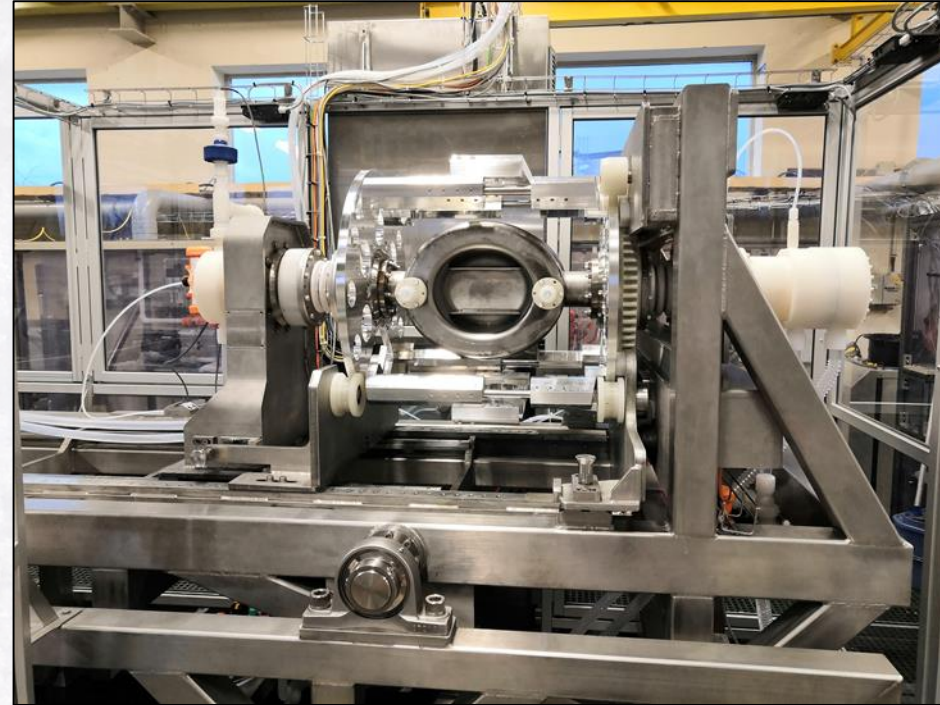


Cleaning and cleanliness assessment

Inorganic based contaminants: Oxides, precipitates... Bulk metal dislocations/voids/inclusions



1.7 m³ capacity



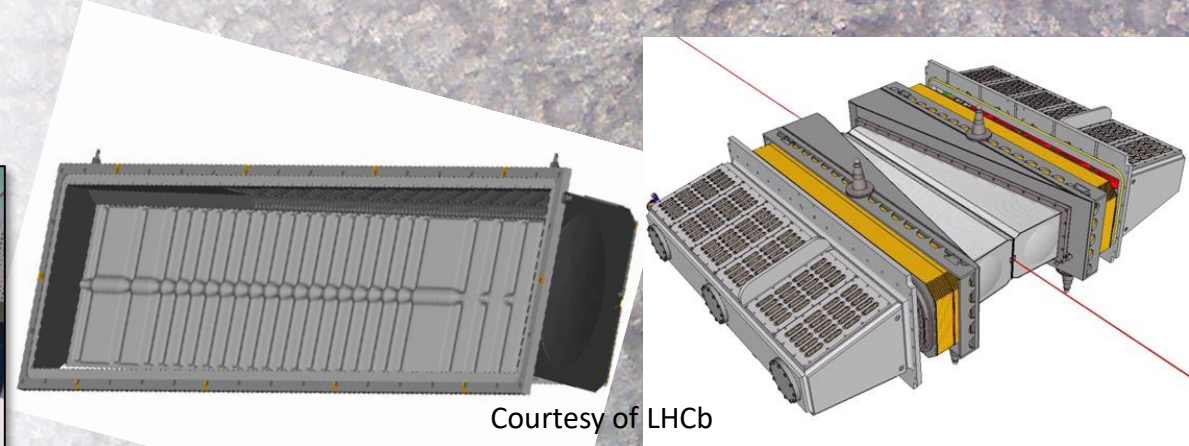
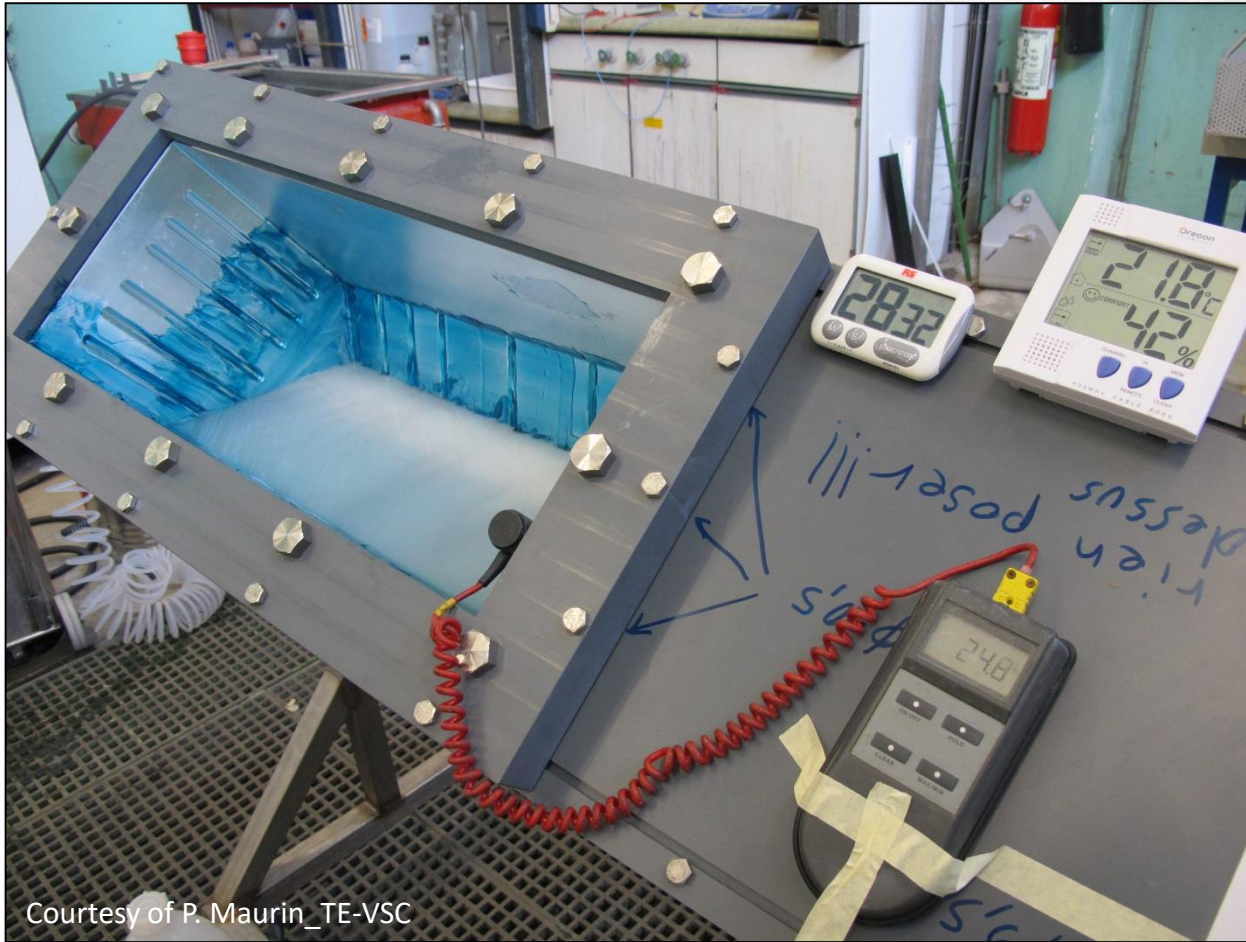
Chemical/electrochemical polishing of RF structures

Alkaline pickling/etching bath
for aluminium based components

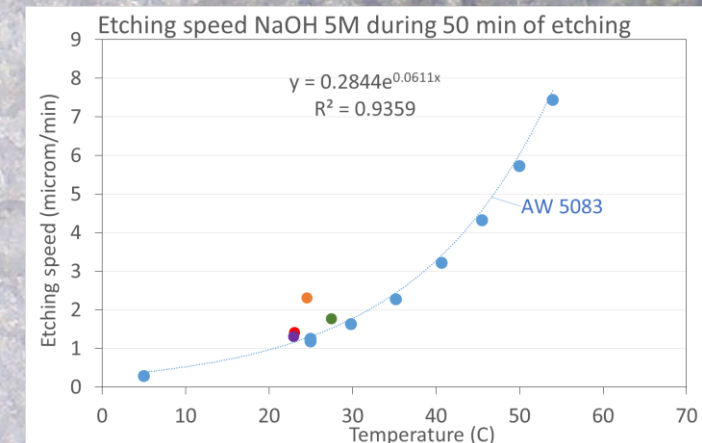


Cleaning and cleanliness assessment

Etching application: Thinning of VELO RF chamber



Machining down to 300 μm thick and chemical etching down to 150 μm thick



Alkaline etching bath of aluminium EN AW 5754

Cleaning and cleanliness assessment

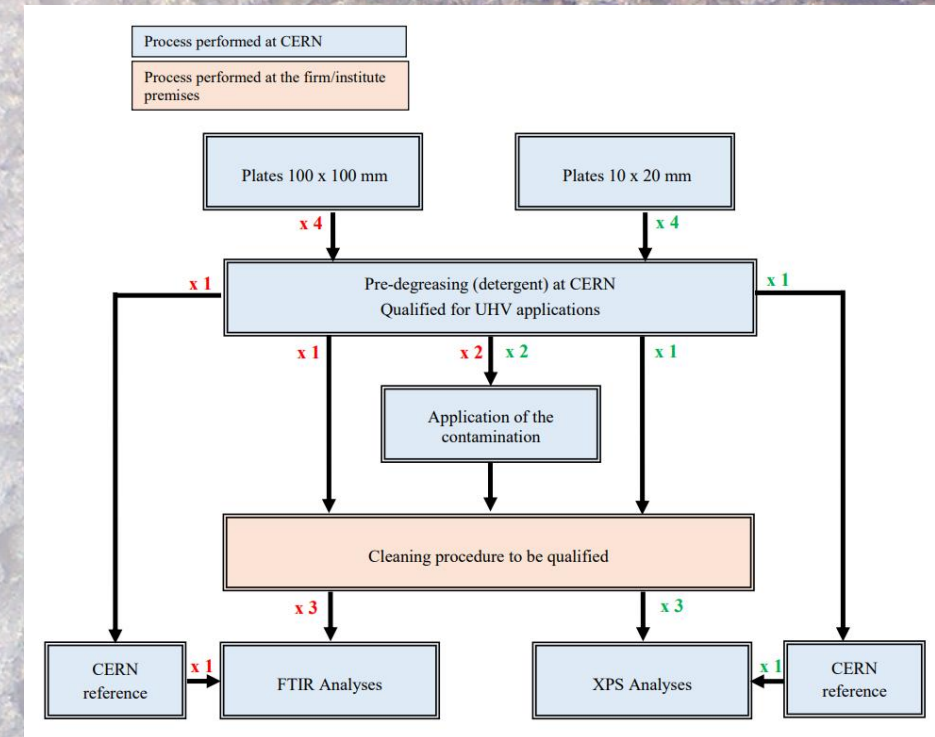
Clean surface: Clean enough?

Assessment of a degreasing agent or degreasing procedure

Procedure

Procedure to qualify the effectiveness of a cleaning method for ultra-high vacuum applications

<https://edms.cern.ch/document/1726970/2>



3.1 Stainless steel surface for UHV applications:

[XPS and FT-IR threshold values](#) (EDMS 347564):

Element	Analysis technique	Maximum allowed quantity on stainless steel	
C	XPS ¹	ESCA5400: 46.3 at.%	SPECS: 31.3 at.%
	IR-FT	< 0.02 AU **	



Electroplating

Rhodium Plating

Gold Plating

Silver Plating

Copper Plating

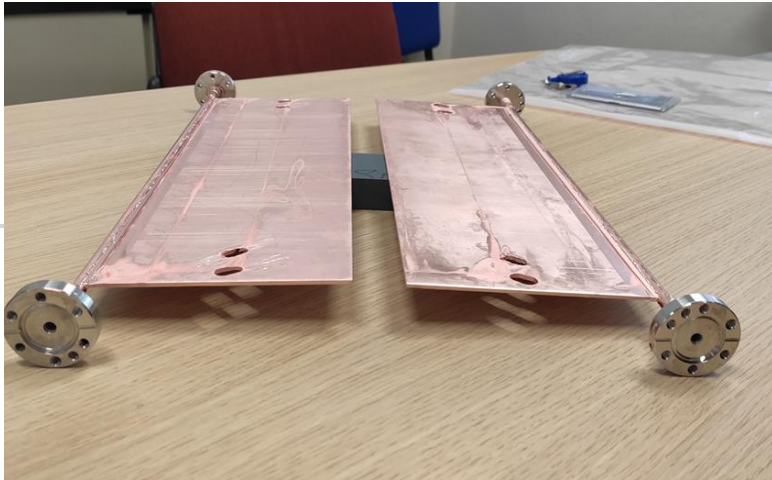
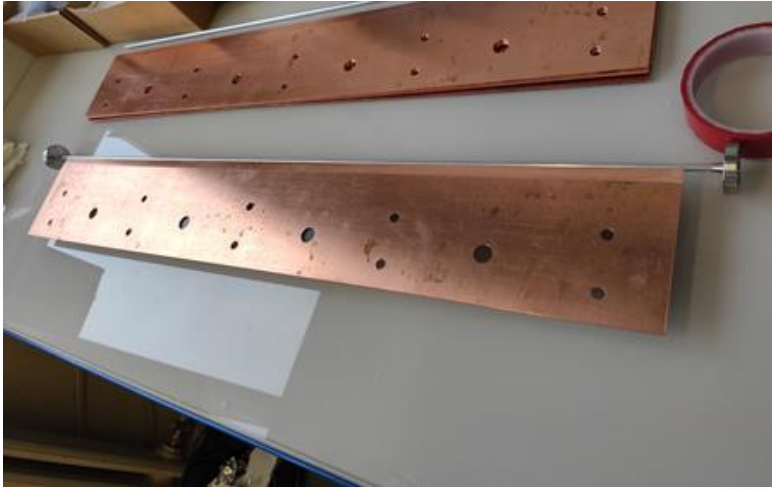
Nickel Plating



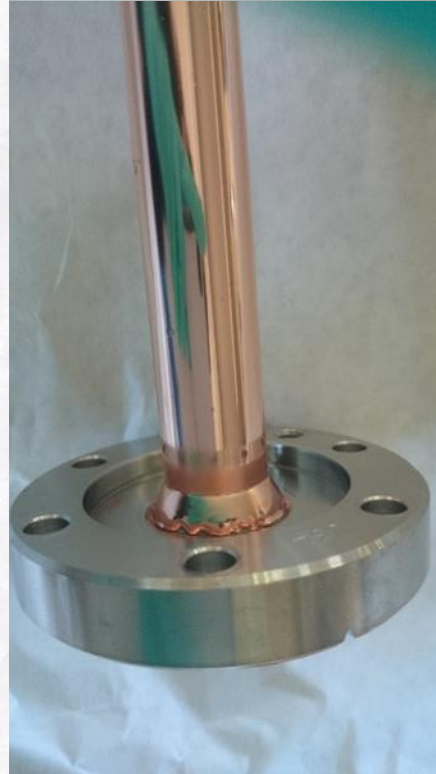
Photos from TE-VSC activities

Electroforming

Assembly of parts

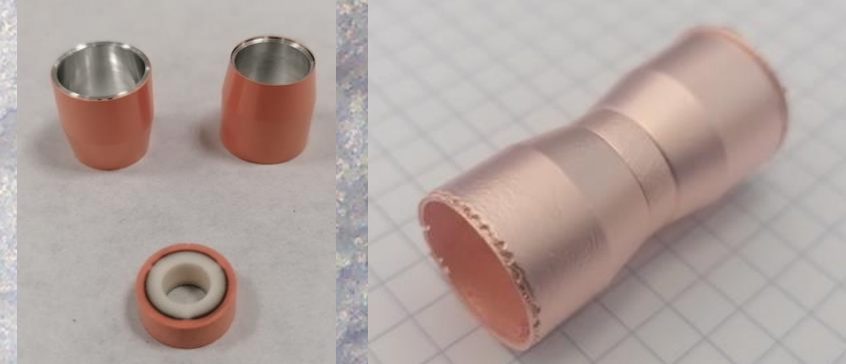


Copper & Copper



Copper & Stainless steel

Photos from TE-VSC activities



Courtesy of F. Fesquet _ TE-VSC

Ceramic & copper



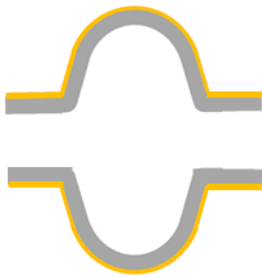
Electroforming

Parts production: Seamless cavities

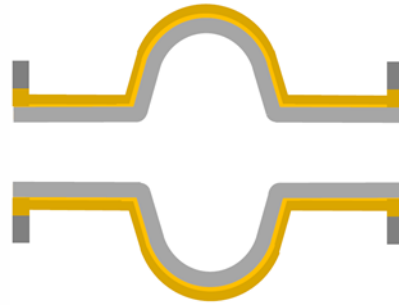
1) Preparation of Al mandrel



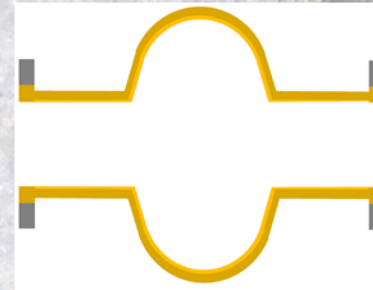
2) Cu PVD thin film



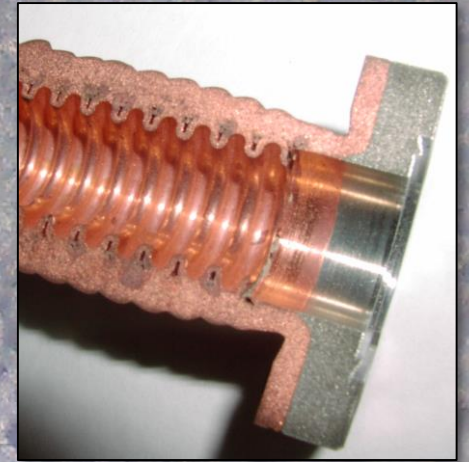
3) Cu electroforming and flanges assembly



4) Mandrel etching



- Seamless cavities (**No EB welding**)
- Stainless steel flanges assembled during electroforming



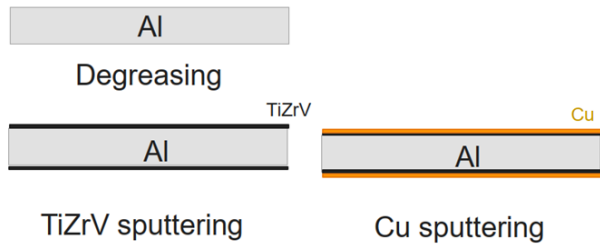
Photos from TE-VSC activities



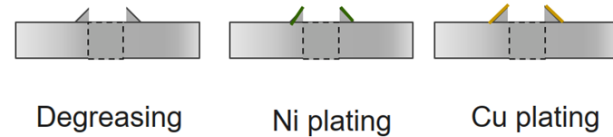
Electroforming

Parts production with thin films: Small Diameter NEG Coated Vacuum Chambers

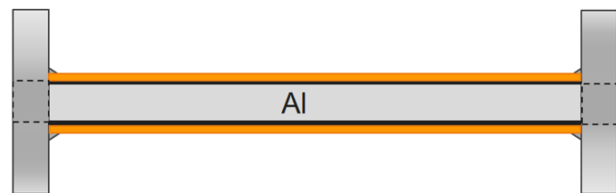
1. Mandrel preparation



2. Flange preparation



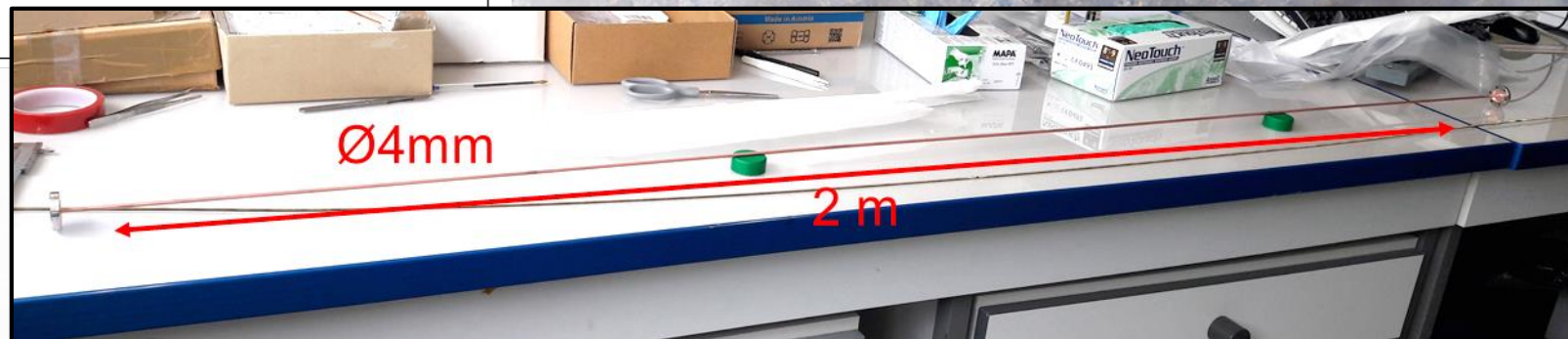
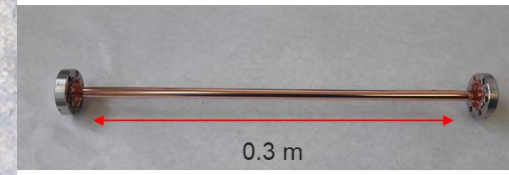
3. Cu electrodeposition



4. Mandrel removal



Chamber 5 mm diameter

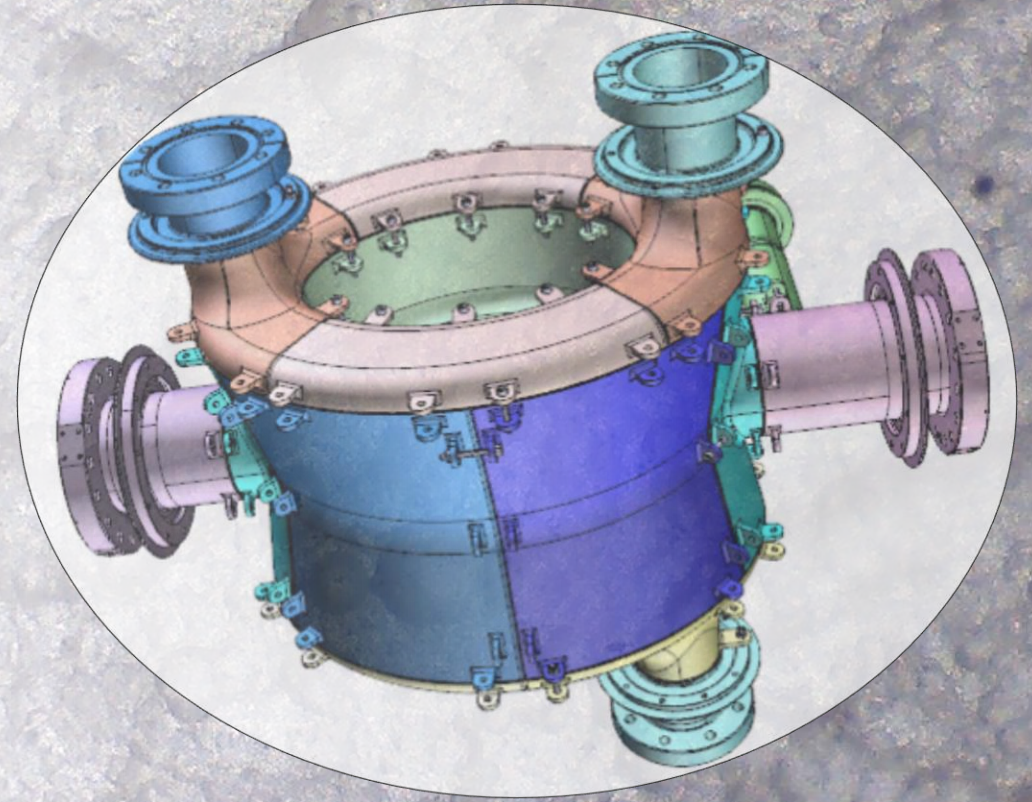


Photos from TE-VSC activities



Electroplating/forming on 3D printed polymers

Fast prototyping / Mandrel for electroforming





Thank you for
your attention

