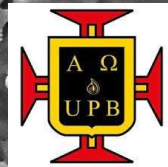


FORMATION OF PEO COATINGS ON BINARY MATERIAL Mg-33wt%Ti PROCESSED BY HIGH ENERGY BALL MILLING (HEBM)

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ICM
2022

The 4th International Conference on Materials:
ADVANCED AND EMERGING MATERIALS
19-21 OCTOBER 2022 | BARCELONA, SPAIN



Mg-Ti alloys

Magnesium

Biocompatible

Low density (1,74 g/cm³)

Biodegradable

Easy processing

Resorbable implant material



High reactivity

Accelerated corrosion



Titanium

Corrosion resistance

Low density (4,54 g/cm³)

High mechanical properties

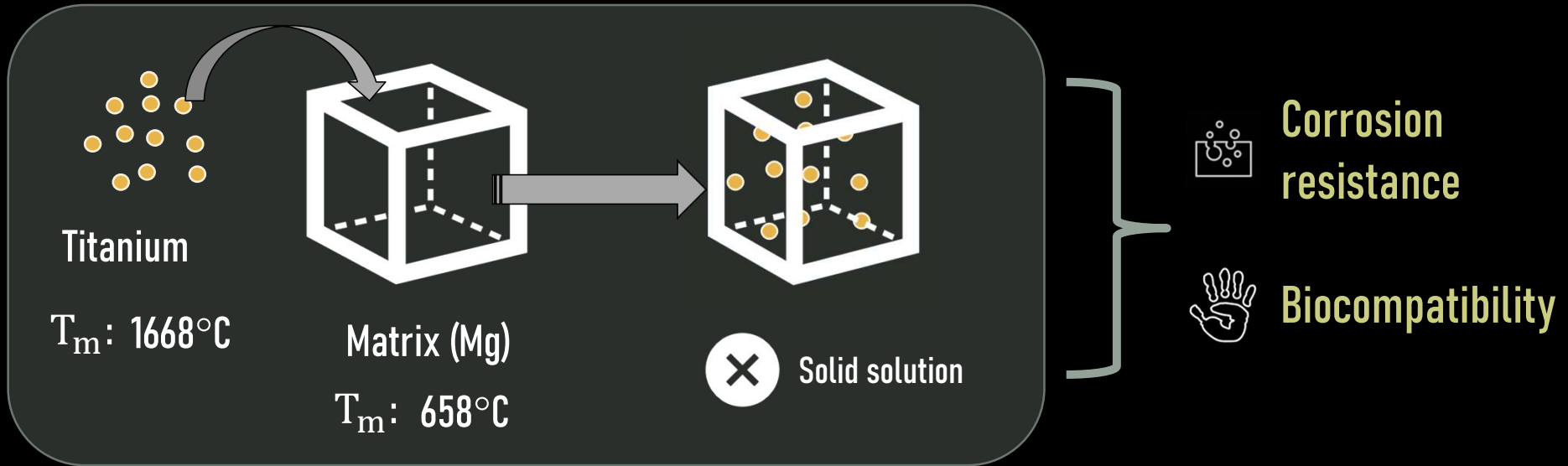
Biocompatible



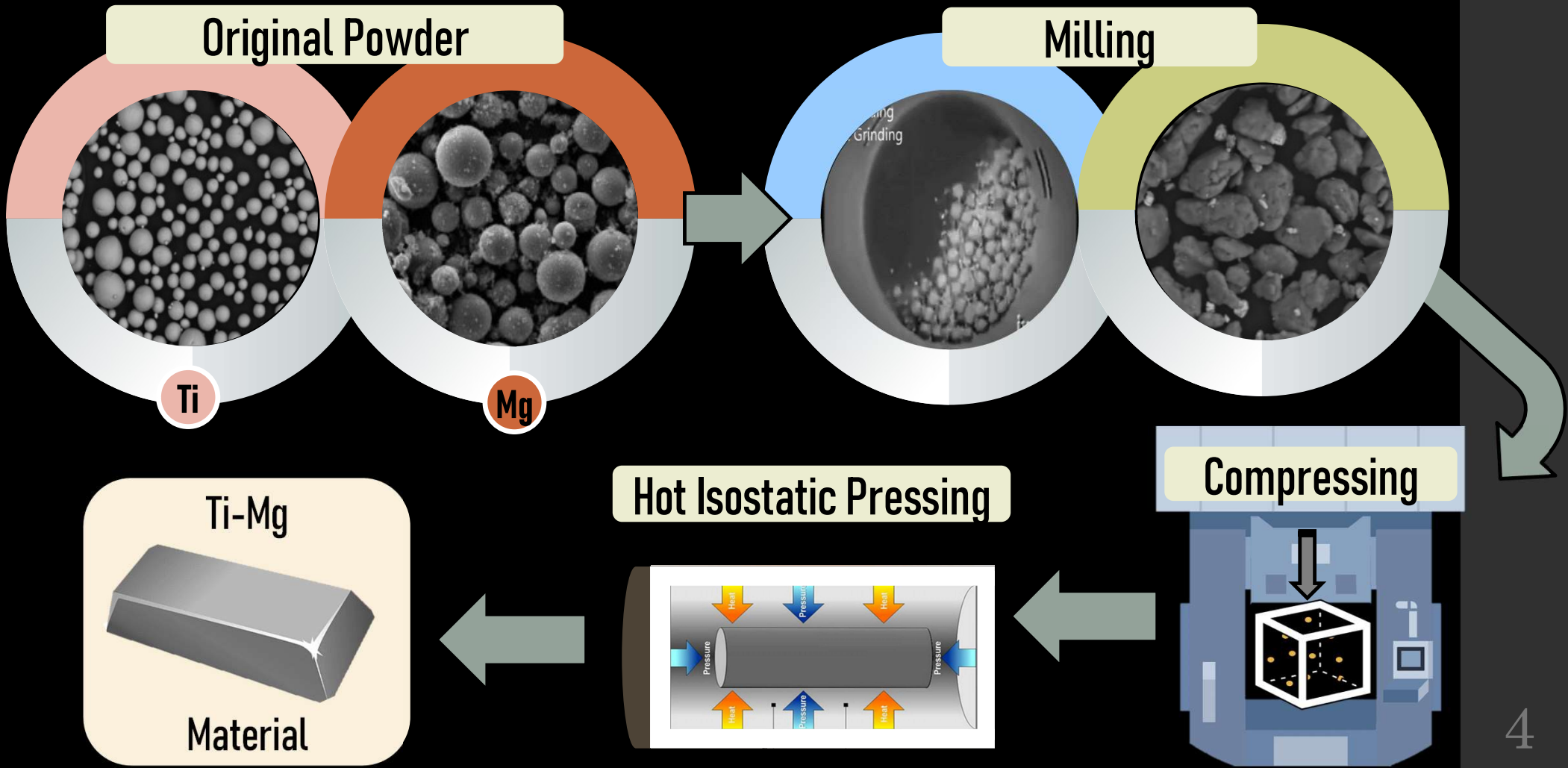


Same final applications
BIOMEDICAL

Admixture in different percent of metals: Improve properties alloy



Processing : High Energy Ball Milling (HEBM)



Surface Modification – Plasma Electrolytic Oxidation

PROPERTIES

Durable and Functional

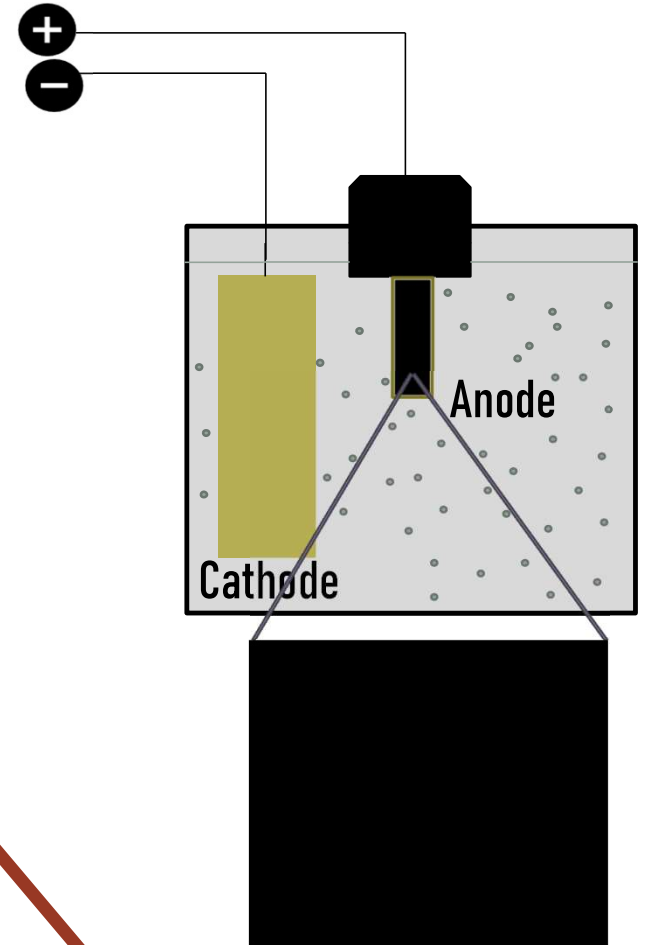
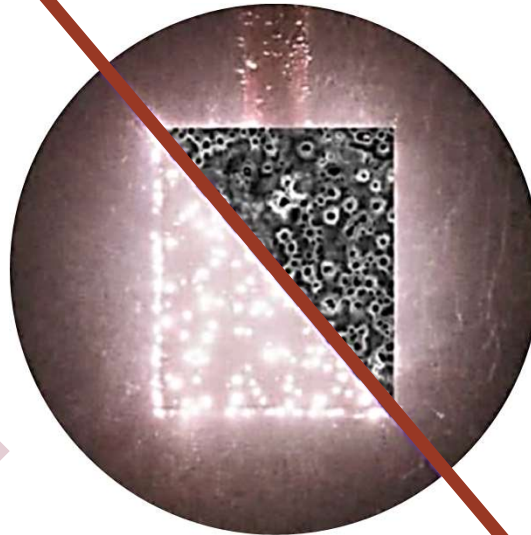
Chemistry - Morphology

Wettability - Charge

Surface energy

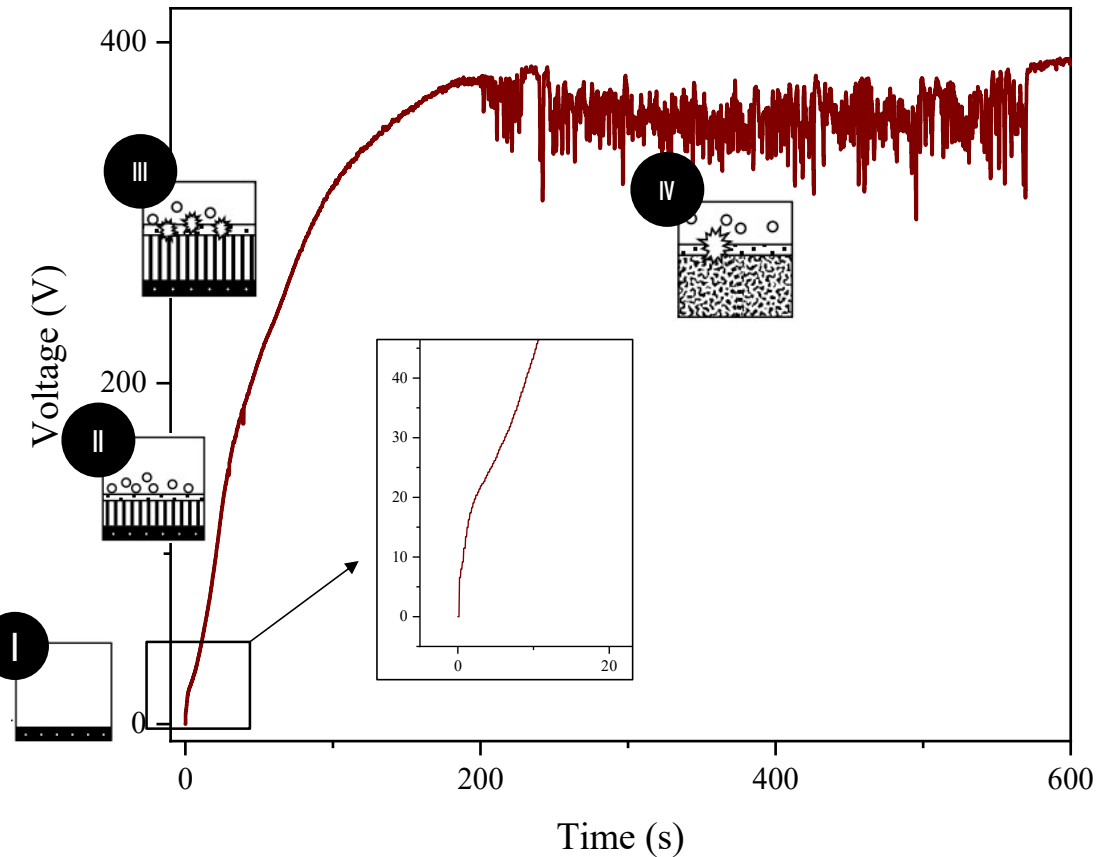
Wear resistance - Corrosion

Biocompatibility



PROCESS

Plasma Electrolytic Oxidation



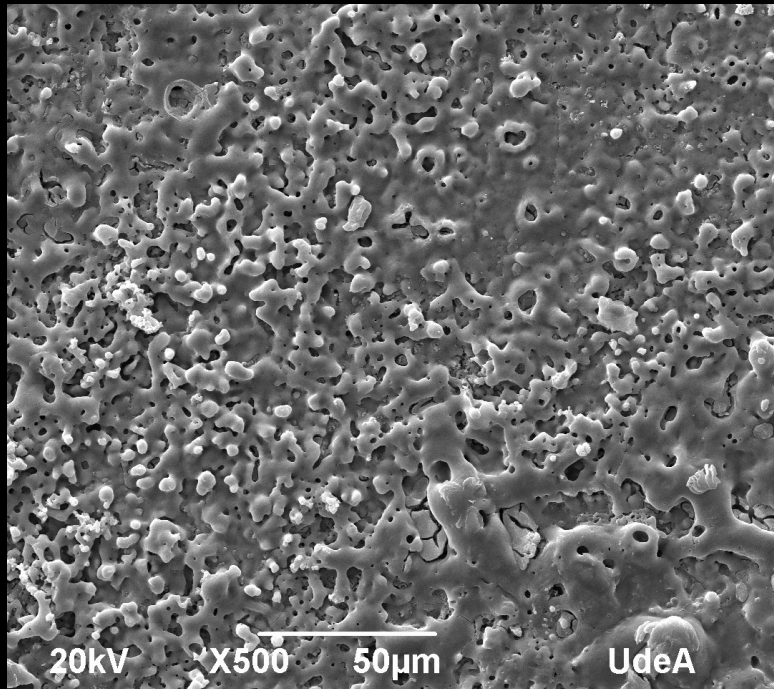
Region I: Voltage increases linearly

Region II – III : Voltage increases rapidly with oxide growth rate and exceeds the critical value

Region IV: Voltage remains stable

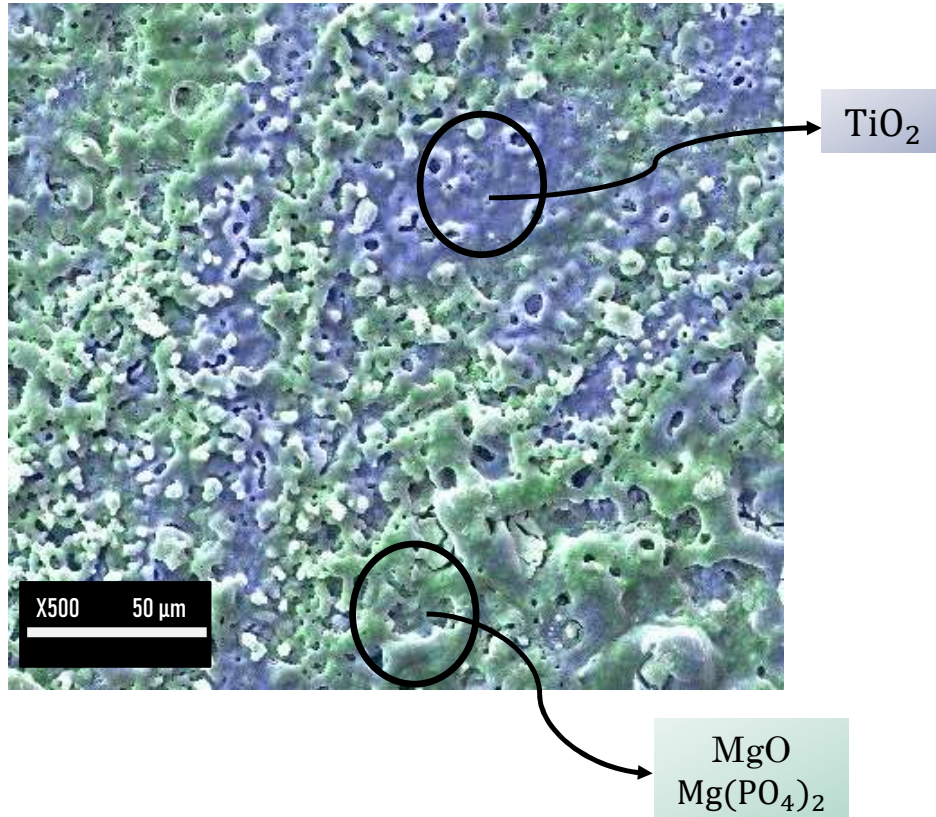
“Voltage breakdown: physical, chemical and electrochemical processes”

Morphology Surface (SEM)

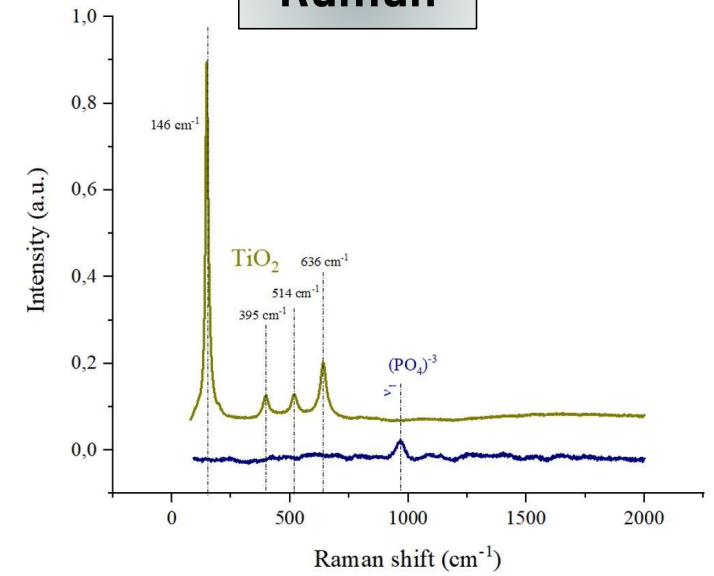


- Typical surface porosity
- Anodic layer with circular and volcano type porous
- Porosity in $2,6 \times 10^3 \mu\text{m}^2$: 7%

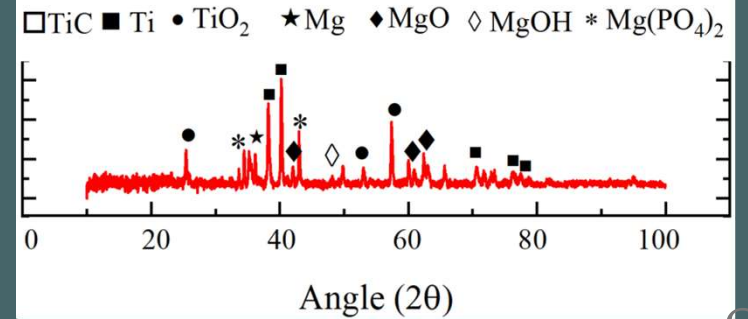
SEM-BSE mapping



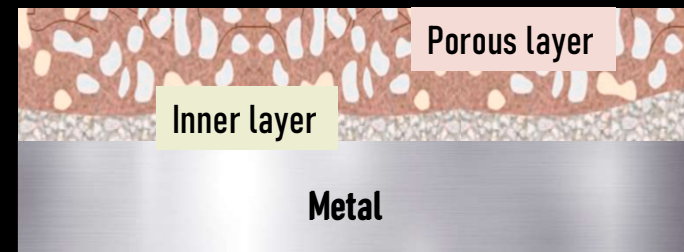
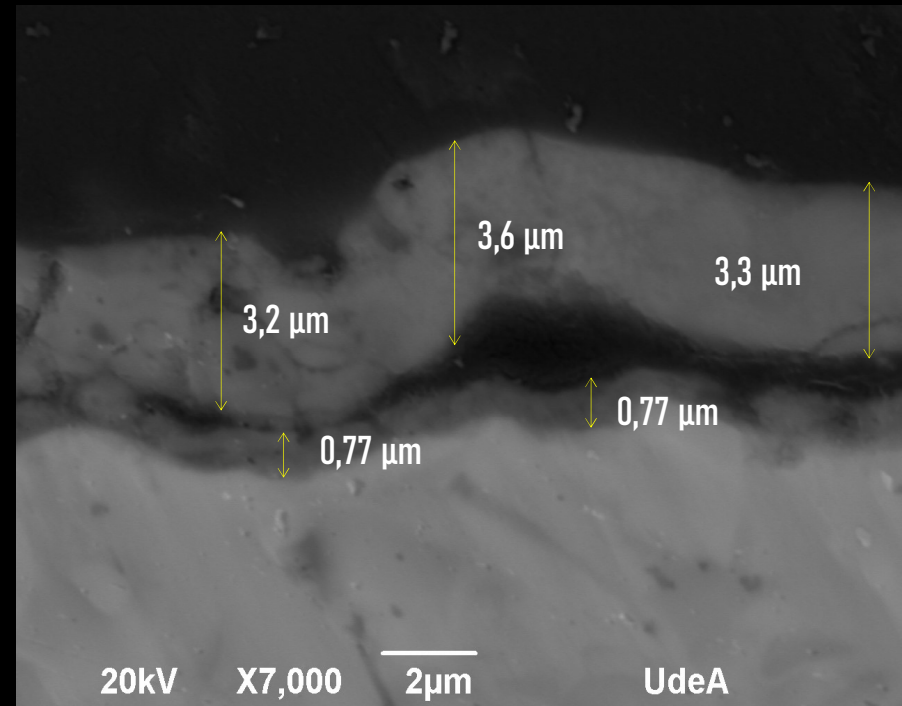
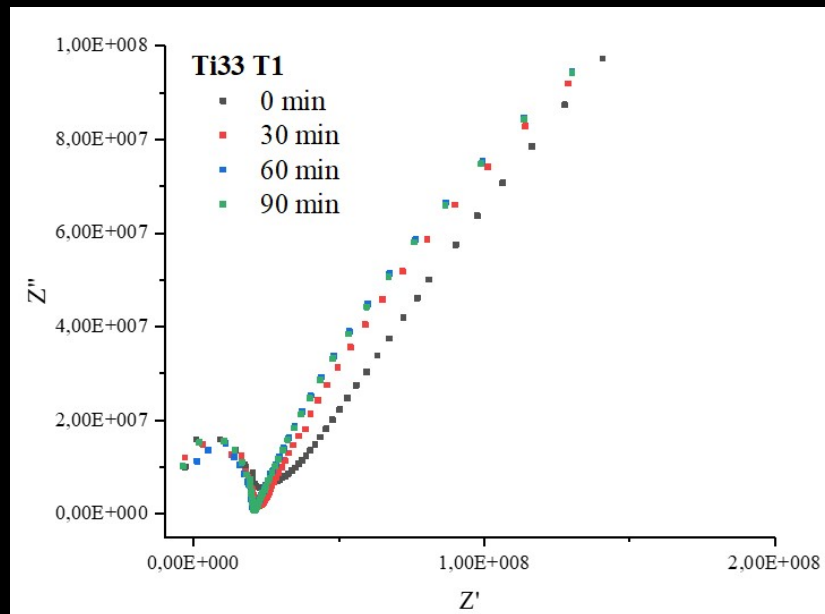
Raman



XRD



Electrochemical Impedance Spectroscopy



CONCLUSIONS



A binary metal formed by powder metallurgy was successfully obtained



The process parameters in PEO were adequate to obtain a homogeneous anodic layer on the surface rich in oxides and phosphates.



It was confirmed that the growth of the coating starts with an innermost oxide layer and then the growth of the ceramic coating starts after overcoming the dielectric breakdown voltage. That is, it is composed of an inner compact layer and an outer porous layer.



The corrosion resistance is mainly determined by the compact/barrier layer.

THANK YOU

Comments and Questions



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