



**RESEARCH  
UNIVERSITY**  
EXCELLENCE INITIATIVE  
Ministry of Science  
and Higher Education



Silesian  
University  
of Technology



**Electrochemistry  
Group**

***FUNCTIONALIZATION OF TITANIUM-BASED IMPLANTS WITH USE OF PLASMA  
ELECTROLYTIC OXIDATION***

**Wojciech Simka**

**Workshop**

**Institute of Atomic Physics and Spectroscopy; University of Latvia**

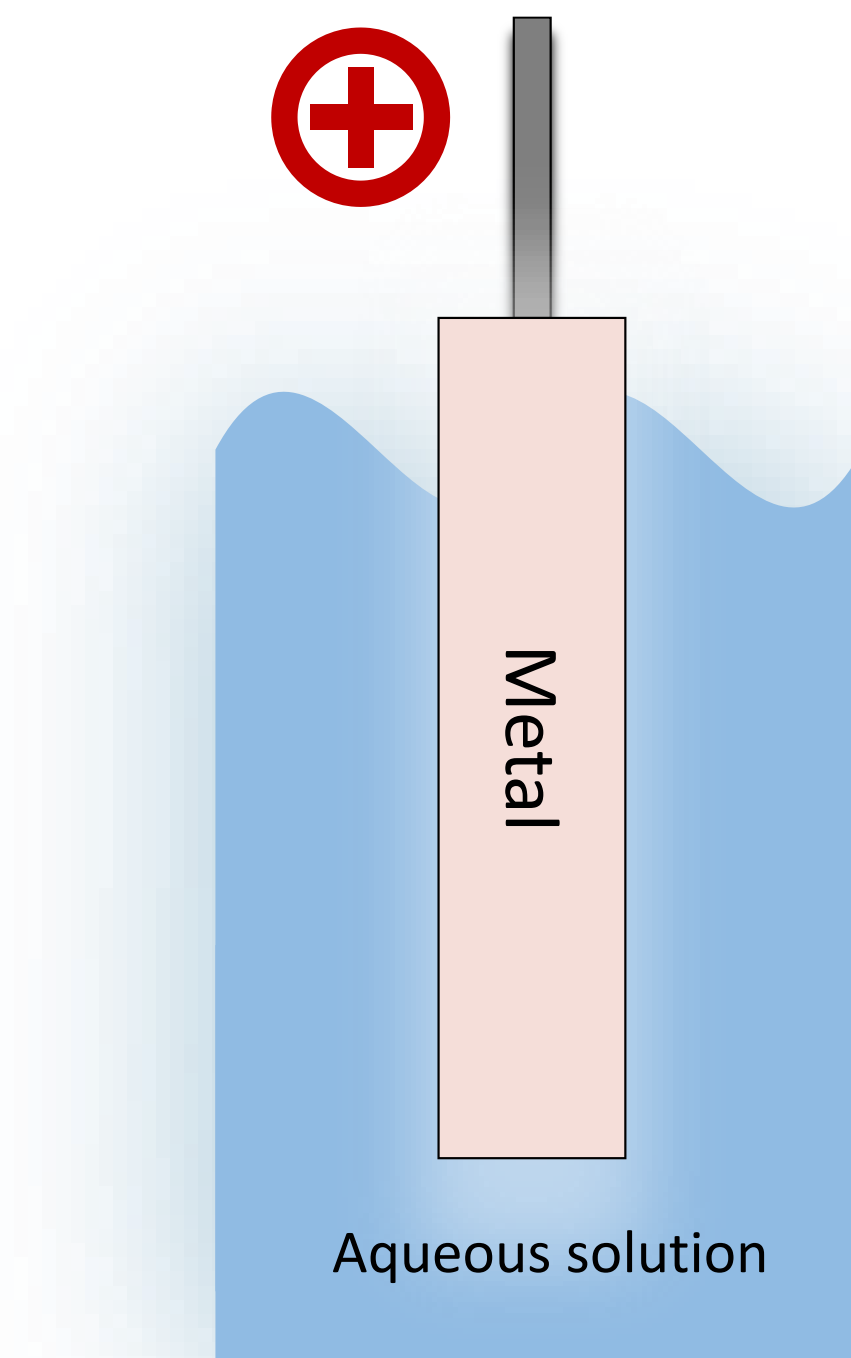
**12.04.2024**

# Anodic oxidation of metals and alloys

The process is based on **anodic polarisation** of the treated element

As a result of the process is

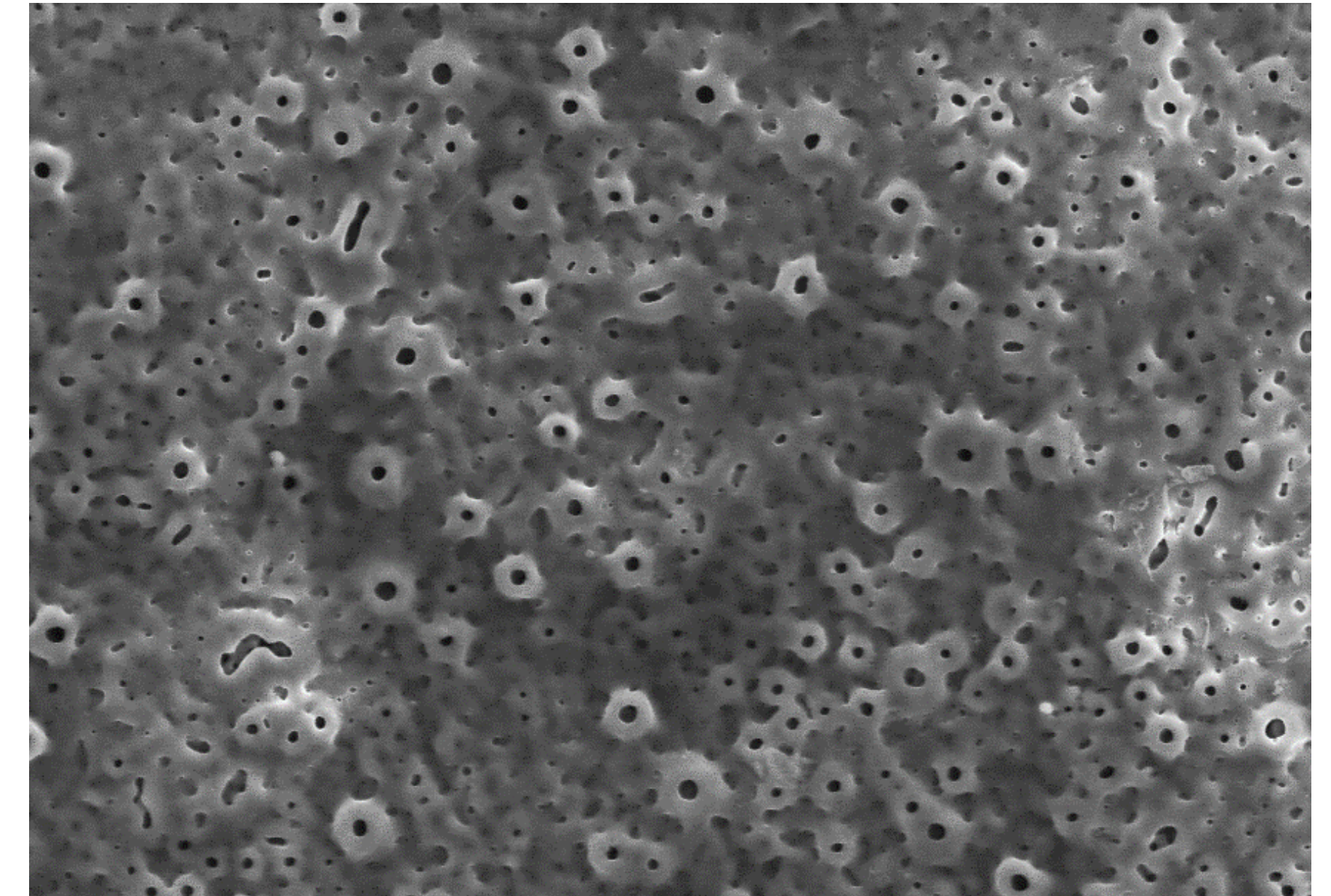
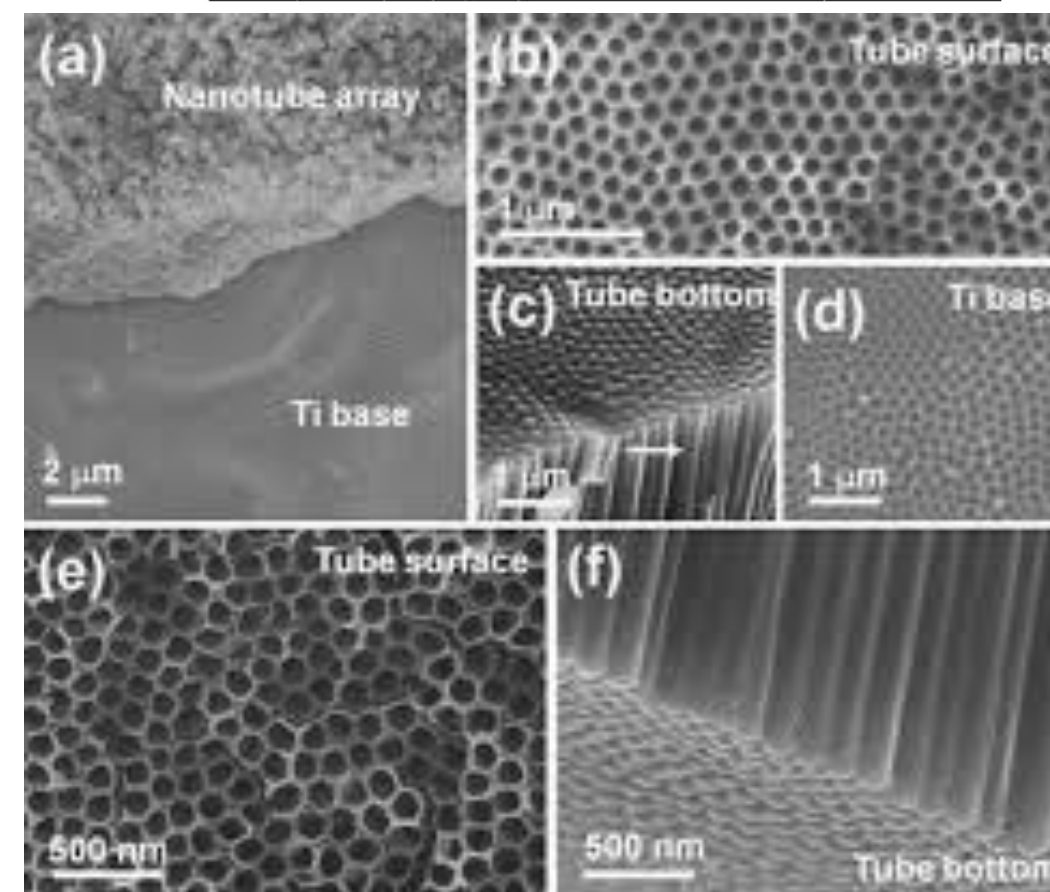
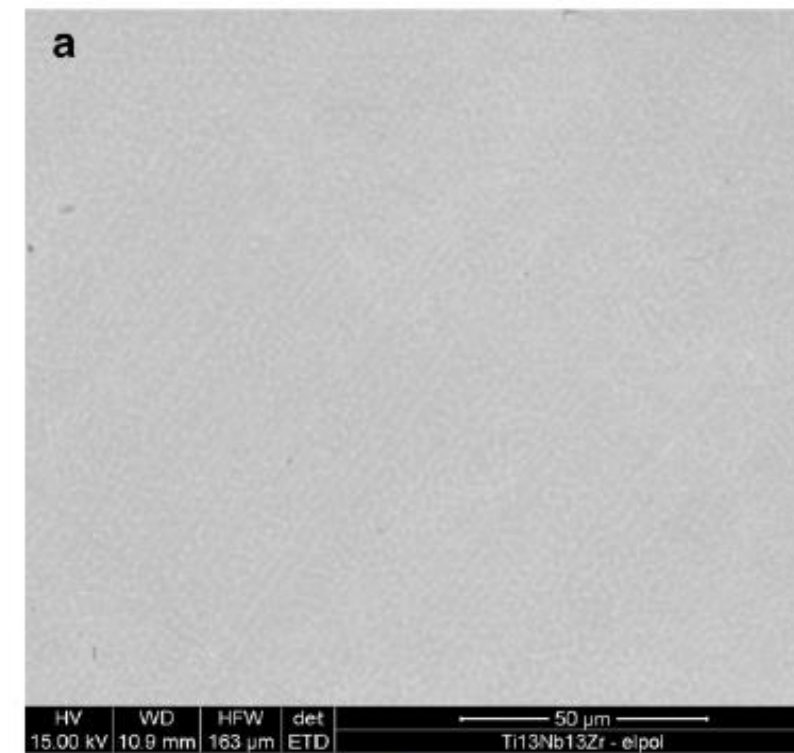
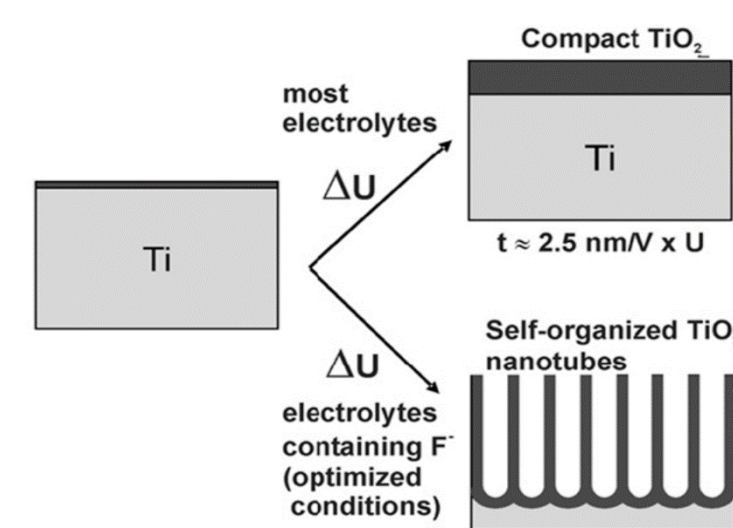
???



# „ANODIC OXIDATION”

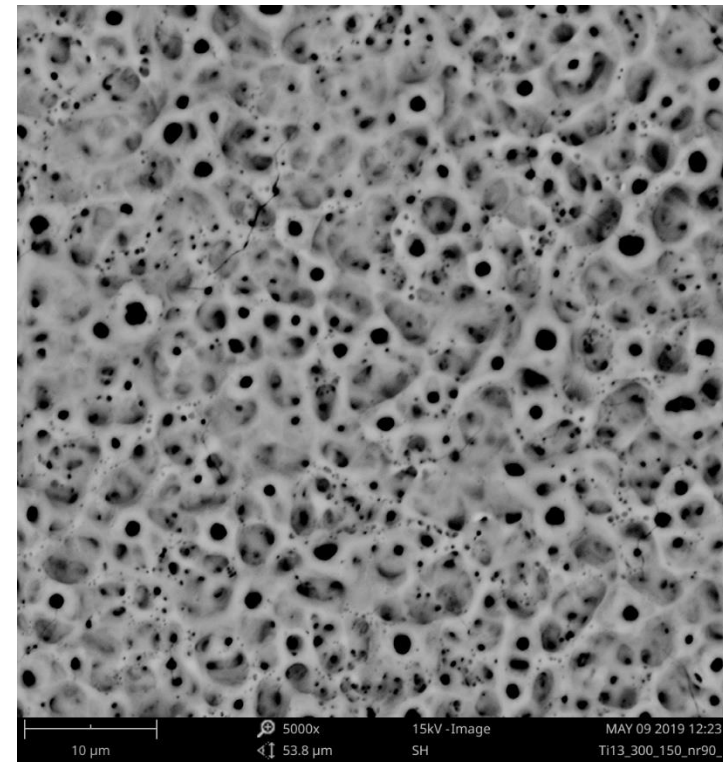
„PEO”

$F^-$  concentration = 0

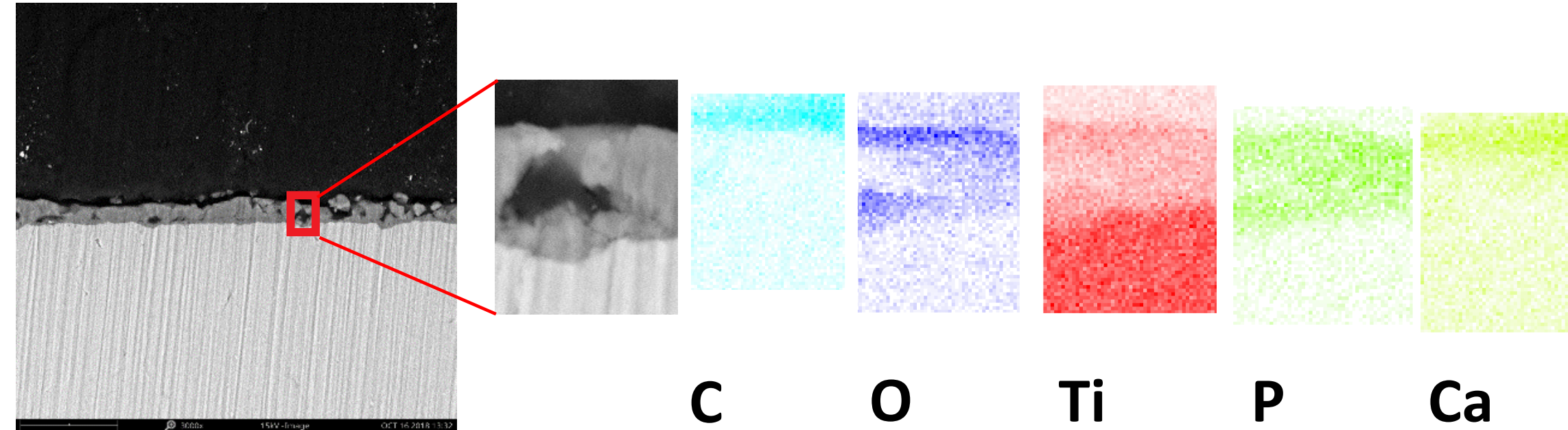


$F^-$  concentration = small

# WHY PEO PROCESS?



A SEM image of the Ti sample after plasma electrolytic oxidation

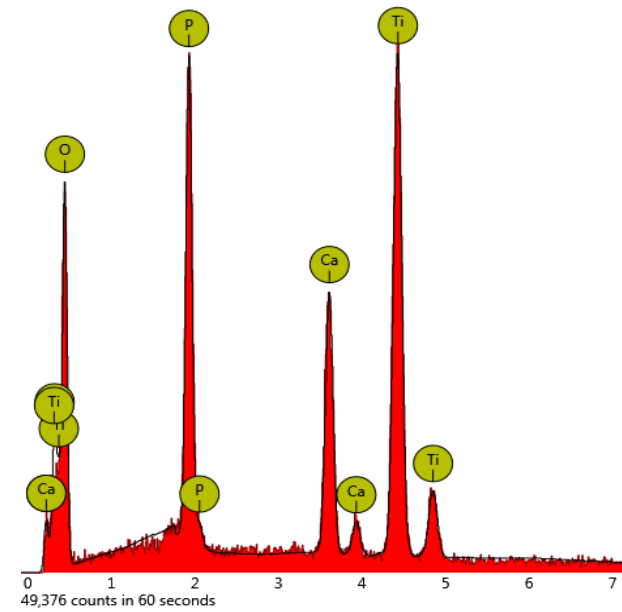


A cross-section analysis and an EDX mapping of the Ti sample after plasma electrolytic oxidation

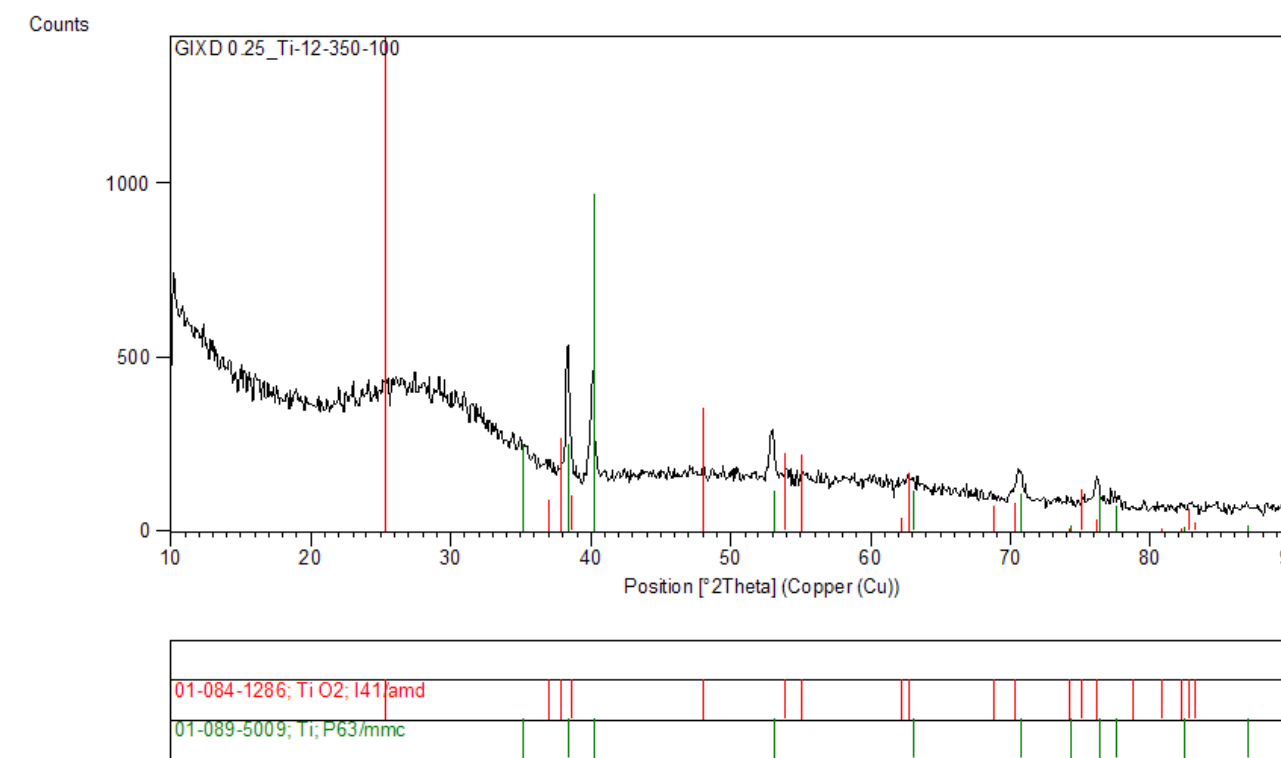
Ca  
P  
Si  
Mg

HA, TCP  
HA, TCP  
CaSiO<sub>3</sub>, SiO<sub>2</sub>

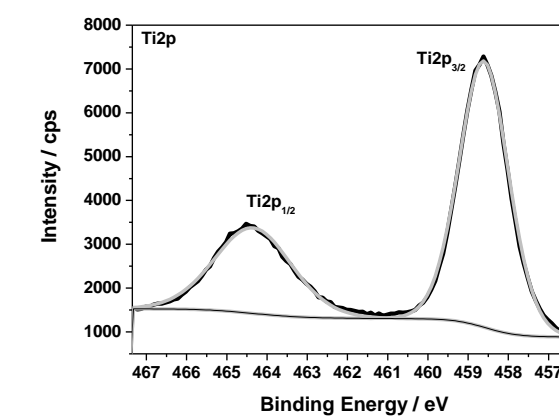
4



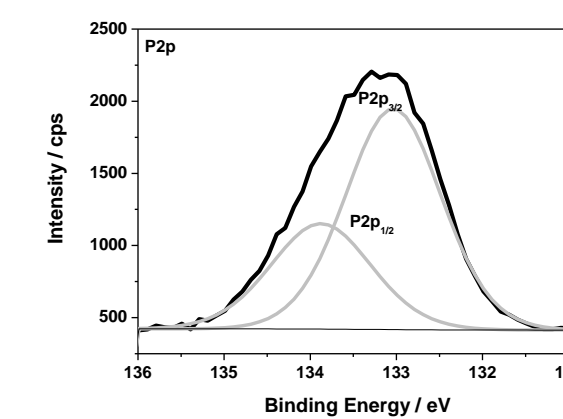
An EDX spectrum of the Ti sample after plasma electrolytic oxidation



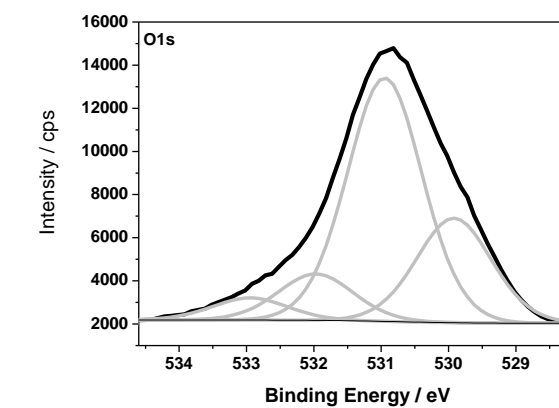
An XRD spectrum of the Ti sample after plasma electrolytic oxidation



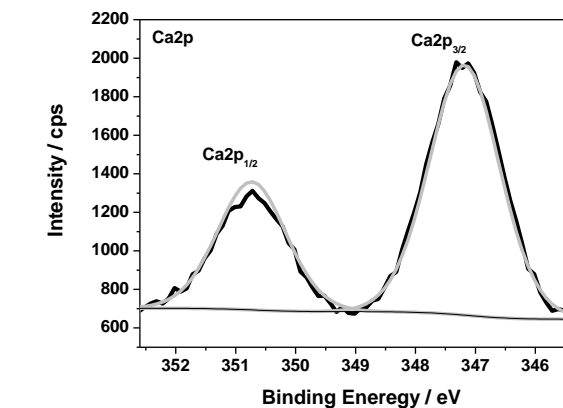
TiO<sub>2</sub>



PO<sub>4</sub><sup>3-</sup>  
H<sub>2</sub>PO<sub>4</sub><sup>-</sup>



TiO<sub>2</sub>  
PO<sub>4</sub><sup>3-</sup>

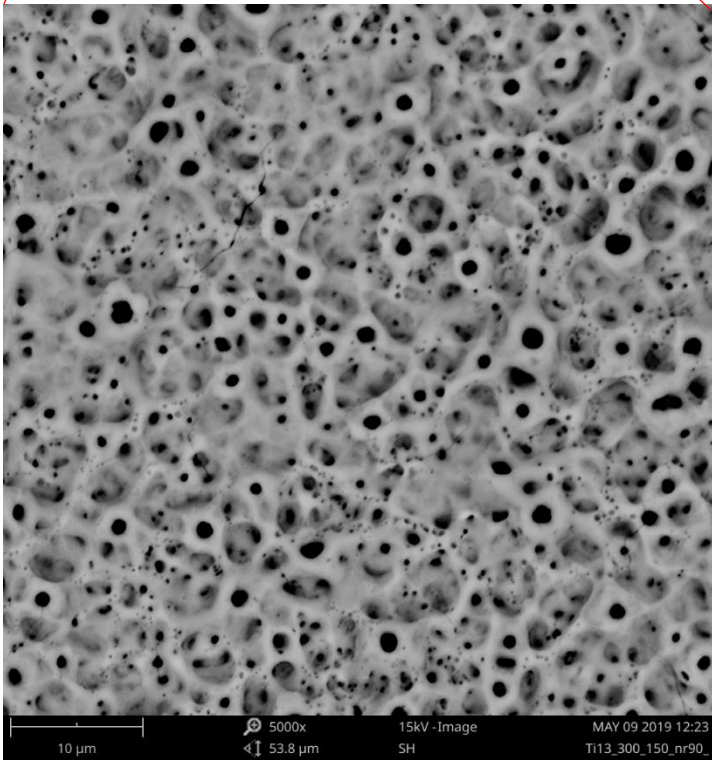


Ca<sub>3</sub>(PO<sub>4</sub>)<sub>2</sub>

A detailed XPS analysis of the Ti sample after plasma electrolytic oxidation

# SCALE UP OF ANODIZATION PROCESS – PROBLEMS AND CHALLENGES

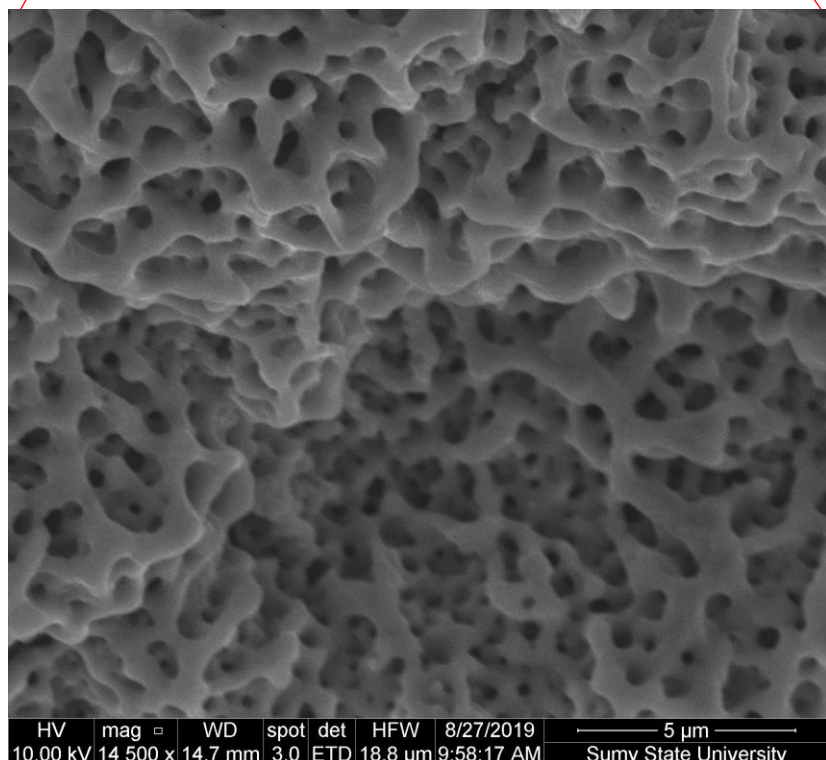
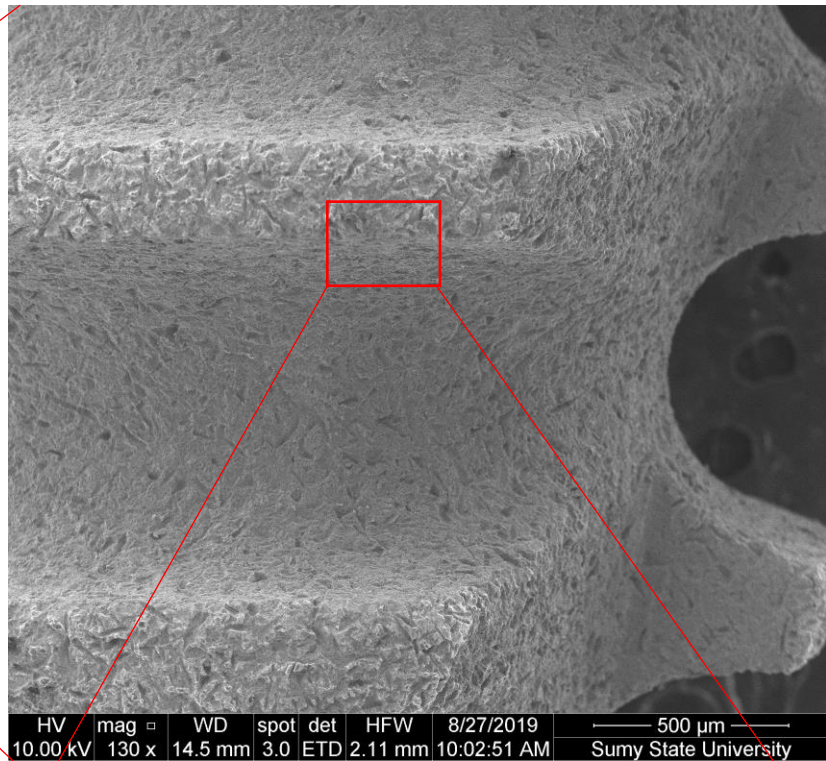
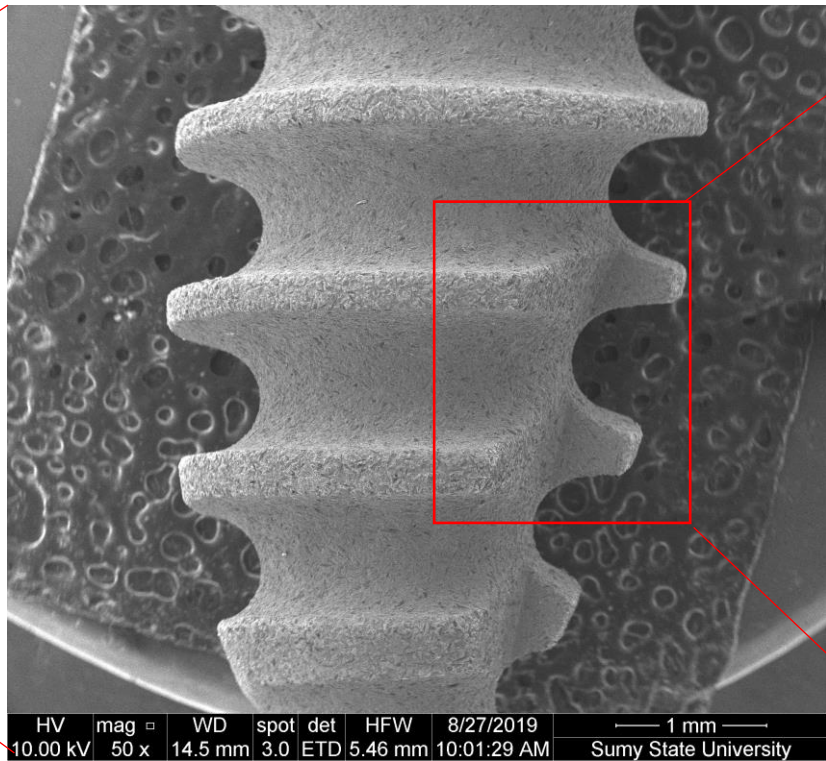
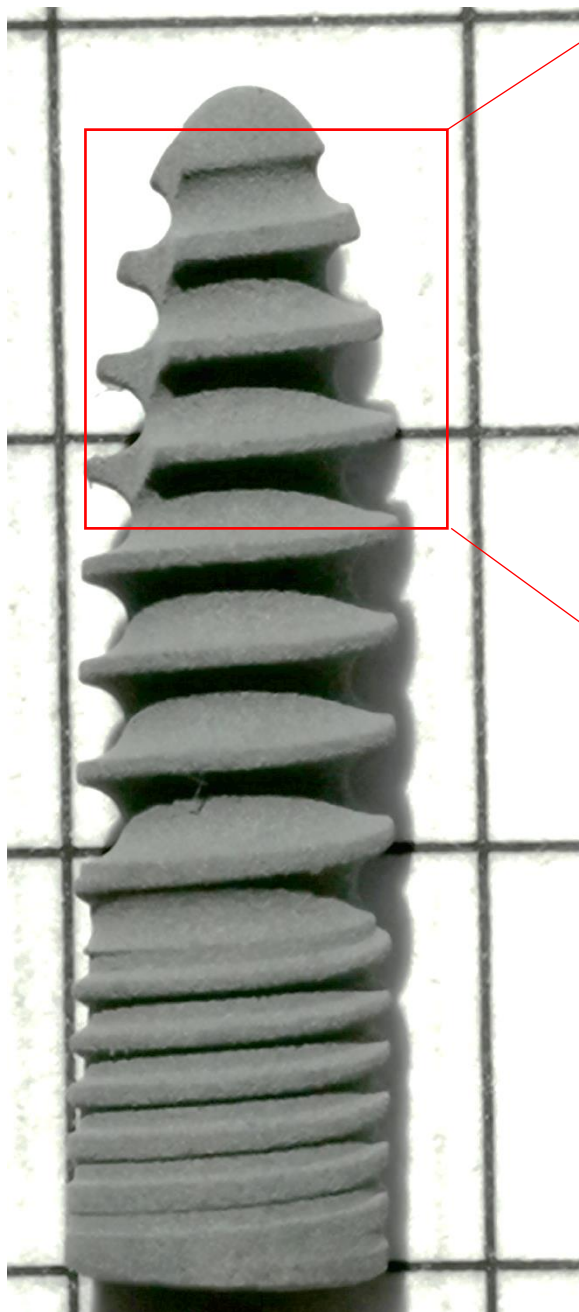
5



A sample from a laboratory; Ti after plasma electrolytic oxidation

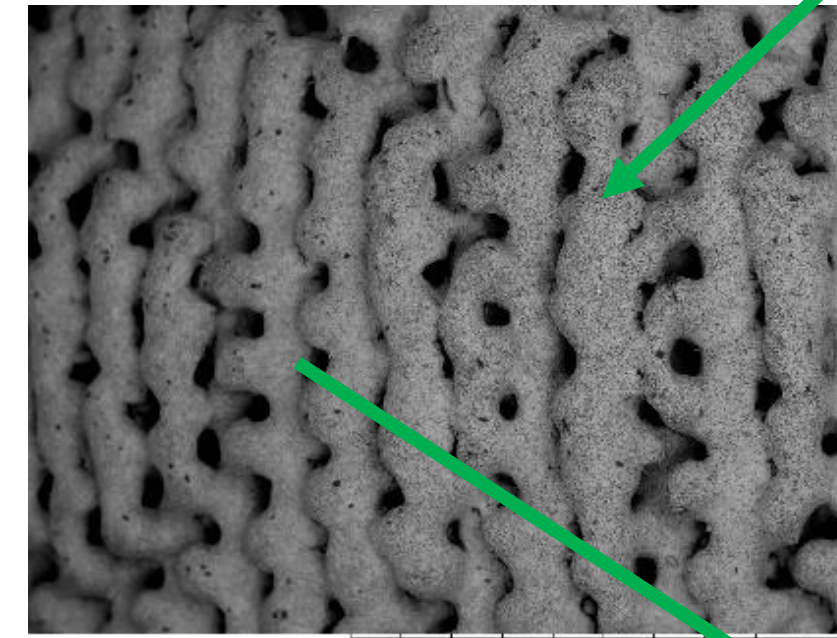
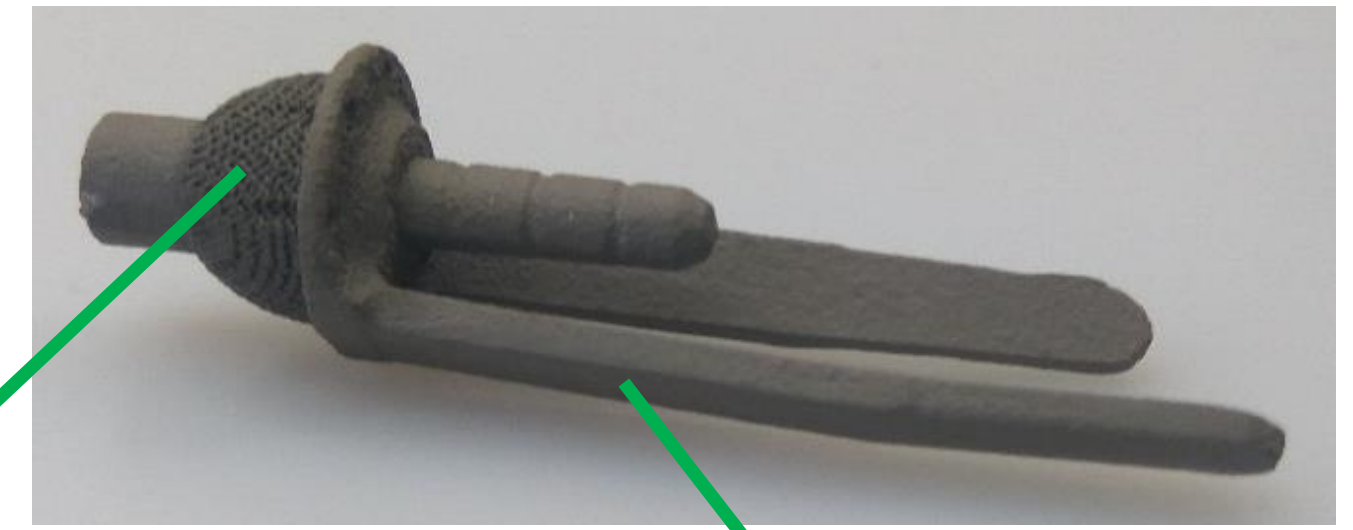
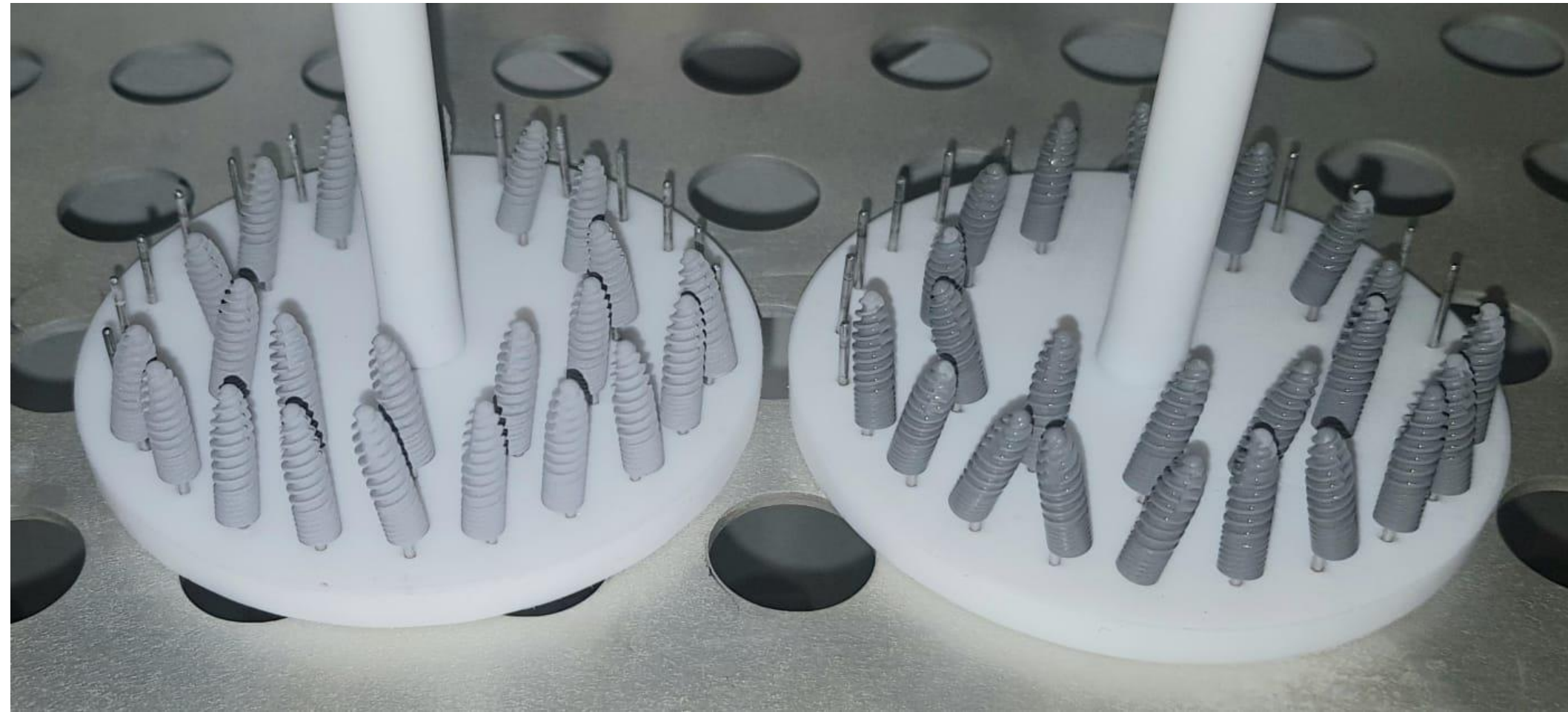
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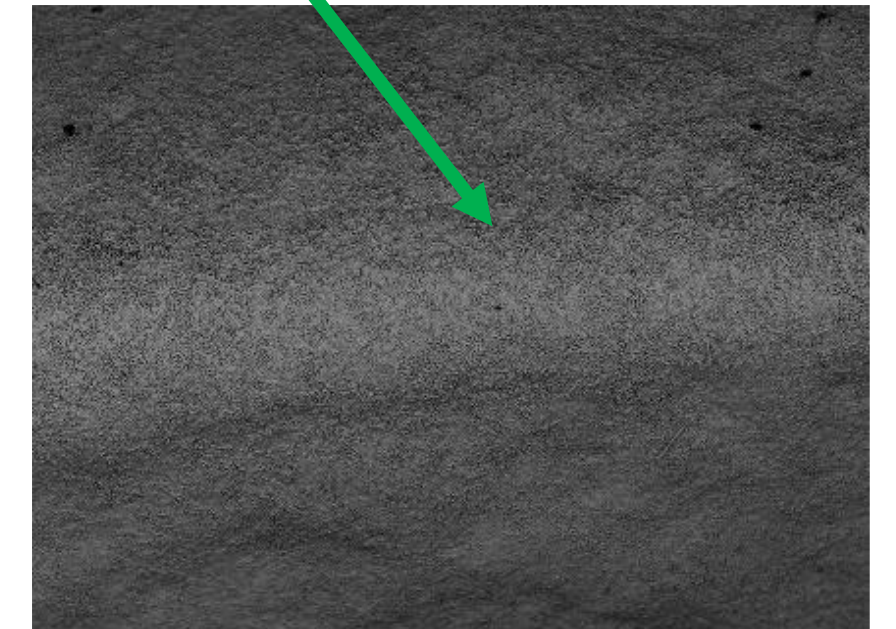


A real dental implant after plasma electrolytic oxidation; Ti grade 4; Nano Prime, Dębica

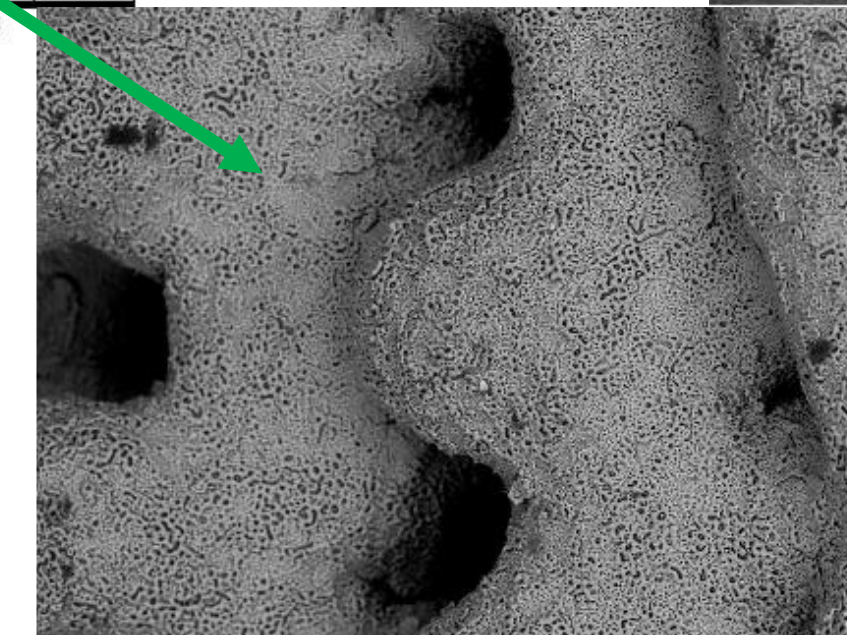




Gr4PEO 8-3 HL D5.7 x50

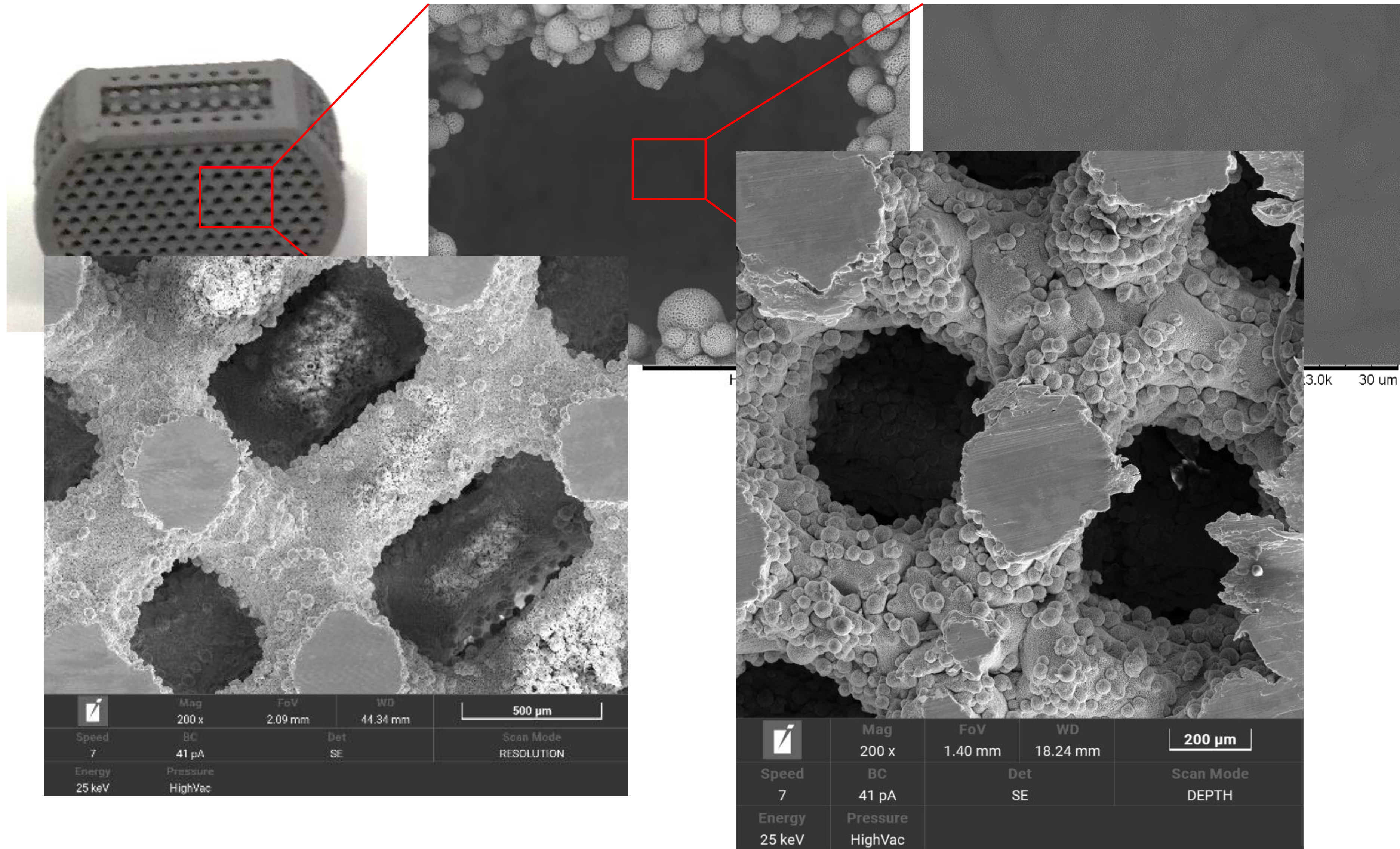


HL D11.5x100 1mm



Gr4PEO 8-3 HL D5.9 x250 300 um





## Acknowledgements





# CONTACT

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