

# PVD NANO-COATING SPECIALISTS

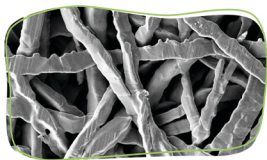
Naco is 100% **hydrogen** industry focused, mass scale ready, developing novel materials and, cost-efficient nano-coatings for electrolyzer and fuel cell system components.

○ **ELECTROLYZERS**

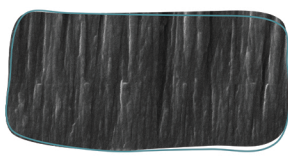
○ **FUEL CELLS**

## HIGH-SPEED MAGNETRON SPUTTERING

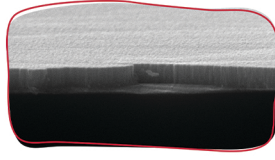
Naco's HMS merges the superior quality of PVD and ALD technologies with the cost-efficiency and scalability of mass-production methods like electroplating.



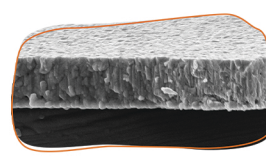
Platinum for PTL



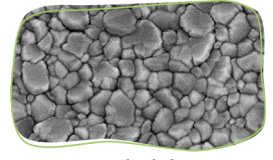
Carbon for BPP



Bimetallic-nitrides  
for BPP



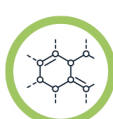
Oxides for  
Interconnects



Nickel for  
Electrodes



**10-40 x  
LESS MATERIAL**

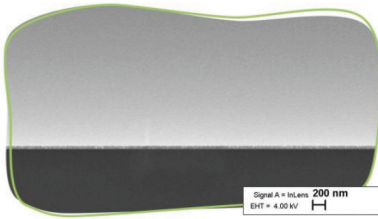


**2x  
LESS CORROSION**



**30-50%  
COST REDUCTION**

# ELECTROLYZERS



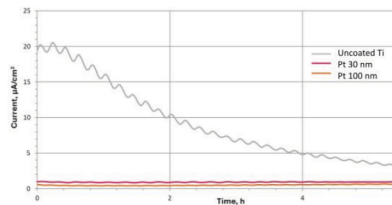
Application	Bipolar plates (BPP)
Material	Pt 99.99%
Thickness, nm	30 – 100
Loading, mg/cm <sup>2</sup>	0.07 – 0.22
Substrate material	Any metal
Substrate thickness, mm	0.05 – 4
Corrosion current <sup>1</sup> , μA/cm <sup>2</sup>	< 0.69
Open circuit voltage (OCV), V	0.8
Interfacial contact resistance (ICR), mΩ·cm <sup>2</sup>	< 4
ICR after 6 hours <sup>2</sup> , mΩ·cm <sup>2</sup>	< 4

<sup>1</sup>Steady-state polarization at 2.2V (vs RHE), water 0.05M sulfuric acid solution, 2 ppm HF at 80°C

## Platinum for BPP Anode (PEMWE)

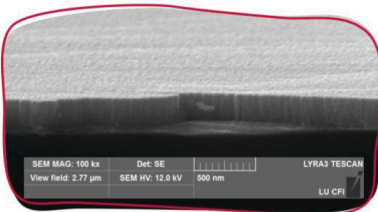
Our platinum coating (**Naco Pt**) for PEM water electrolyzer bipolar plates is significantly thinner, denser and more homogeneous than those applied by conventional methods like electroplating.

That allows to **reduce platinum loading 10 – 40x** at the same time ensuring required conductivity and corrosion protection.



<sup>1</sup>1.1V (vs RHE), water 0.05M sulfuric acid solution, 2 ppm HF at 80°C

## PEMWE Anode



Application	Cathode
Material	Bimetallic nitride with top layer
Thickness, nm	300 – 600
Substrate material	Any metal
Substrate thickness, mm	0.05 – 4
Open circuit voltage (OCV), V	0.8 V
Interfacial contact resistance (ICR), mΩ·cm <sup>2</sup>	< 2
ICR after 6 hours <sup>1</sup> , mΩ·cm <sup>2</sup>	< 2 mΩ·cm <sup>2</sup>
ICR after 24 hours <sup>2</sup> , mΩ·cm <sup>2</sup>	< 2 mΩ·cm <sup>2</sup>

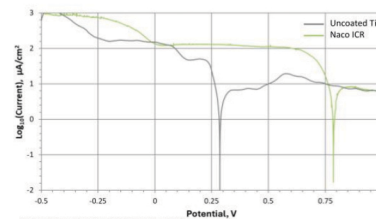
<sup>1</sup>Steady-state polarization at 2.2V (vs RHE), water 0.05M sulfuric acid solution, 2 ppm HF at 80°C

<sup>2</sup>Steady-state polarization at -0.5V (vs RHE), water 0.05M sulfuric acid solution, 2 ppm HF at 80°C

## Bimetallic Nitride for BPP Cathode (PEMWE)

Our bimetallic nitride coating (**Naco ICR**) protects PEM water electrolyzer cathodes **without extensive use of noble materials**.

It consists of three layers. The first provides good adhesion, the second (main) nitride layer prevents hydrogen diffusion, and the few-nanometer top layer ensures **stable conductivity**.

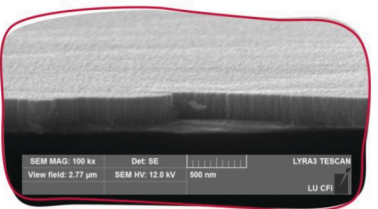


Water sulfuric acid solution pH1 0.1 ppm HF at 60°C

## PEMWE Cathode



# FUEL CELLS



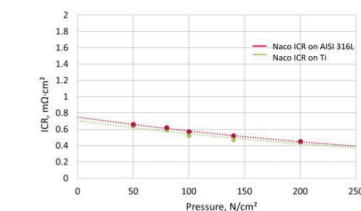
Application	Bipolar plates (BPP)
Material	Bimetallic nitride with top layer
Thickness, μm	0.4 – 0.8
Substrate material	Titanium, Stainless Steel
Substrate thickness, mm	0.05 – 2
Corrosion current <sup>1</sup> , μA/cm <sup>2</sup>	< 0.7
Open circuit voltage (OCV), V	0.8
Interfacial contact resistance (ICR), mΩ·cm <sup>2</sup>	< 1
ICR after 24 hours <sup>2</sup> , mΩ·cm <sup>2</sup>	< 1
Contact angle	84°

<sup>1</sup>Steady-state polarization at 1.1V (vs RHE), water sulfuric acid solution pH3, 0.1 ppm HF at 80°C

## Bimetallic Nitride for BPP (PEMFC)

Our bimetallic nitride coating (**Naco ICR**) protects BPPs **without extensive use of noble materials**. Naco ICR is ranked #1 in the independent performance and degradation tests.

It consists of three layers. The first provides good adhesion, the second (main) nitride layer prevents hydrogen diffusion, and the few-nanometer top layer ensures **stable conductivity**.



1.1V (vs RHE), water 0.05M sulfuric acid solution, 2 ppm HF at 80°C

## PEMFC

