Journée de la recherche hydrogène bretonne
24 Juin 2026 - UBO

Durabilité des matériaux : applications à la production et au transport de l'hydrogène

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PEPR H2 – Projet COSTO

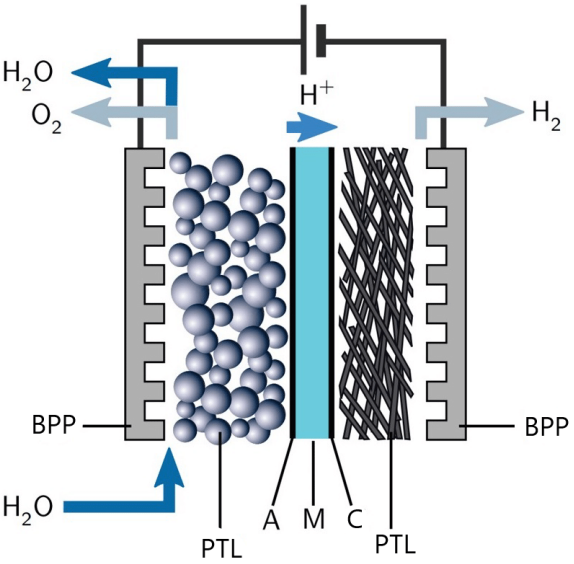
Couches minces anti-corrosion pour les éléments structurels de l'anode des électrolyseurs d'eau à membrane échangeuse de protons (PEMWE)

PEPR H2 : 21 projets sélectionnés

- **Production**
- Stockage
- Conversion/usage
- Systèmes
- Activités transverses

PEPR H2 – Projet COSTO

Context : materials and PEMWE



the PEMWE stack

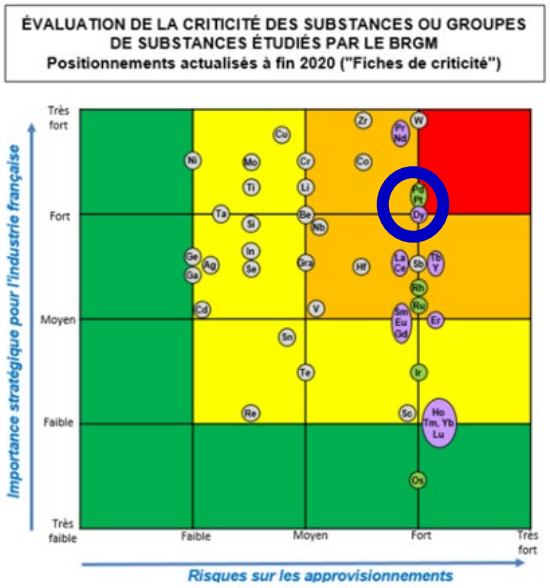
Anodic reaction:

$2H_2O \rightarrow O_2 + 4H^+ + 4e^-$

State-of-the-art materials:

Titanium coated with Pt, Au,

➡ ↘ competitiveness



Substituting coated titanium with 316L stainless steel coated **with cost-effective and low criticality thin-film** coatings

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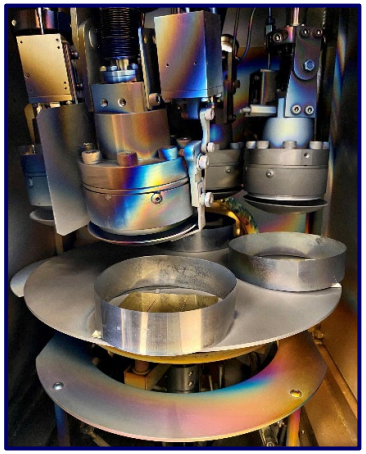
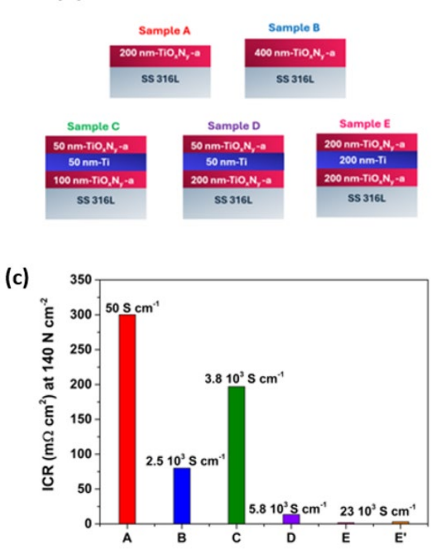
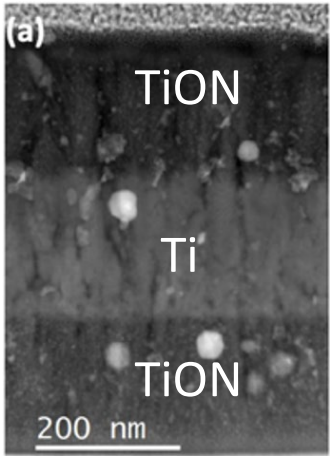
Coatings for BPP : TiON/Steel



PVD chamber

1/Interfacial contact resistance (ICR):





TiON/Ti/TiON/Steel

2/ Operating conditions of BPP:

pH : 4 to 6 @ OCP (60/80°C)

Stability of the coating

Tests for real BPP:

K. Chergui et al, "Protective TiOxNy -based multilayer coatings for 316L stainless steel bipolar plates in a PEM water electrolyzer", *International Journal of Hydrogen Energy*, 178, 151650 (2025).

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Revêtement pour les PTL : Ta/Ti

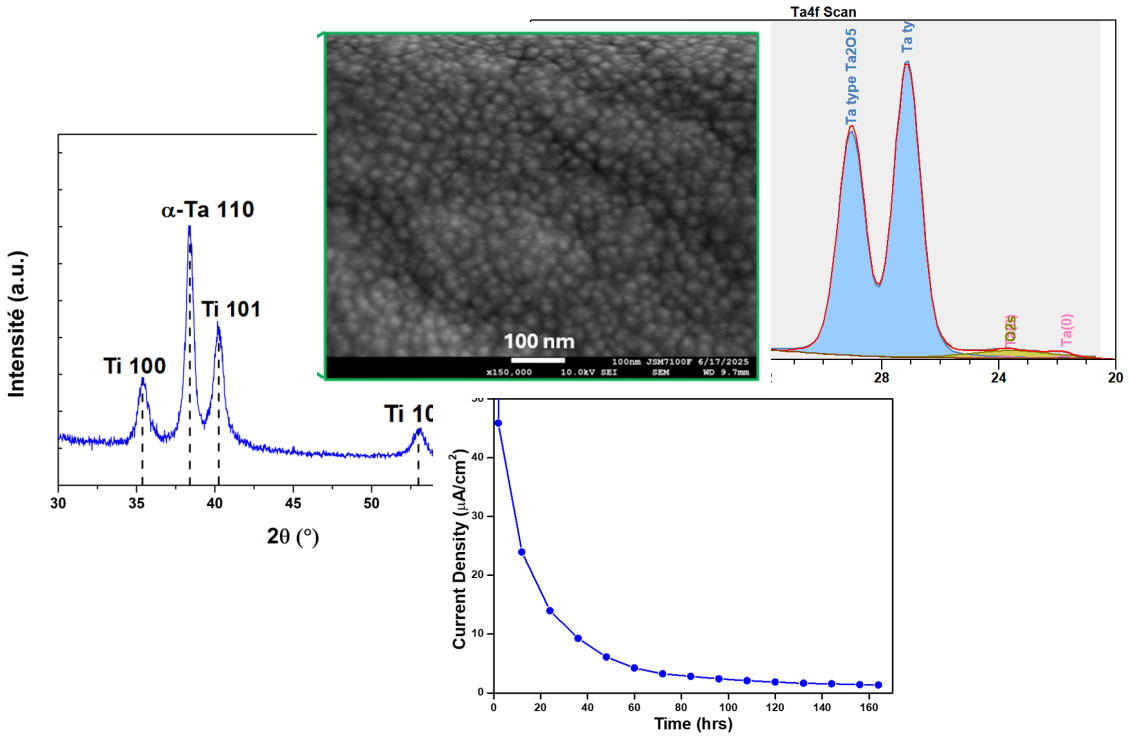
Production (Lab-STICC)

↓

Caractérisation (Lab-STICC et ISCR)

↓

Stabilité (chronoampérométrie @ pH=1 /1,8 V vs RHE) et ICR (Institut de la Corrosion)



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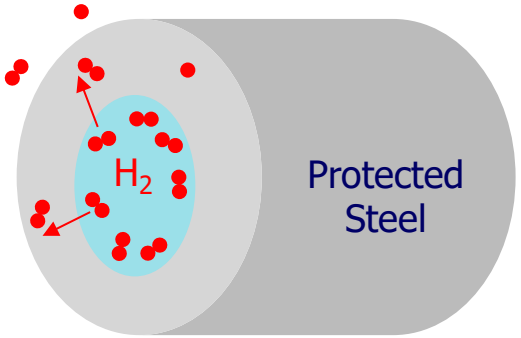
Impact of Hydrogen permeation in steel on polymer adhesion

Lab-STICC

FRENCH CORROSION INSTITUTE

Indian Institute of Technology Bombay



Hydrogen transport in steel pipelines

Diffusion and accumulation in steel
→ Delamination of organic coatings

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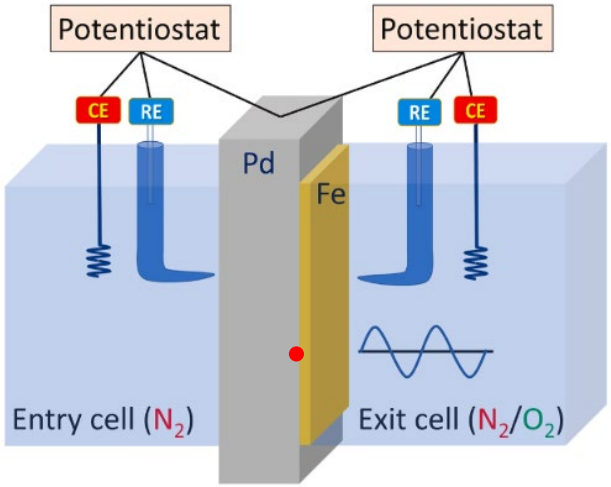
Impact of Hydrogen permeation in steel on polymer adhesion



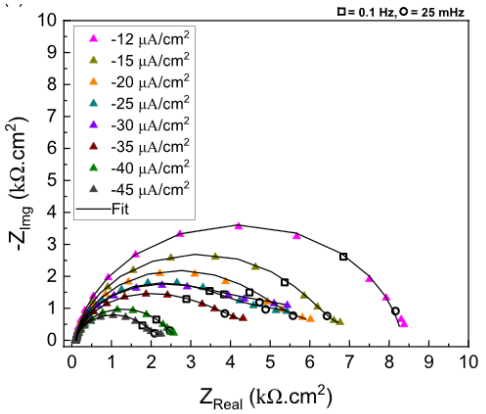
Devanathan-Stachurski setup

Entry cell

Cathodic charging in (0.1 M NaOH)
Atomic hydrogen production

Exit cell

- Diffusion coefficient
- Electrochemical Impedance spectroscopy (EIS)



R.R Tripathy, S. Rioual, B. Lescop, D. Vijayshankar, "Cathodic oxygen reduction kinetics at an organic coating/iron interface using a combined hydrogen permeation based potentiometry and electrochemical impedance spectroscopy technique", *Corrosion science, 244 (2025).*

Equipe « Smart Materials and Related Technologies » (SMART)

Matériaux et corrosion
Capteurs de corrosion

Merci pour votre attention