

ELECTROCHEMICAL HYDROGEN COMPRESSOR – NOVEL CELL DESIGN AND ELECTRODES STRUCTURE

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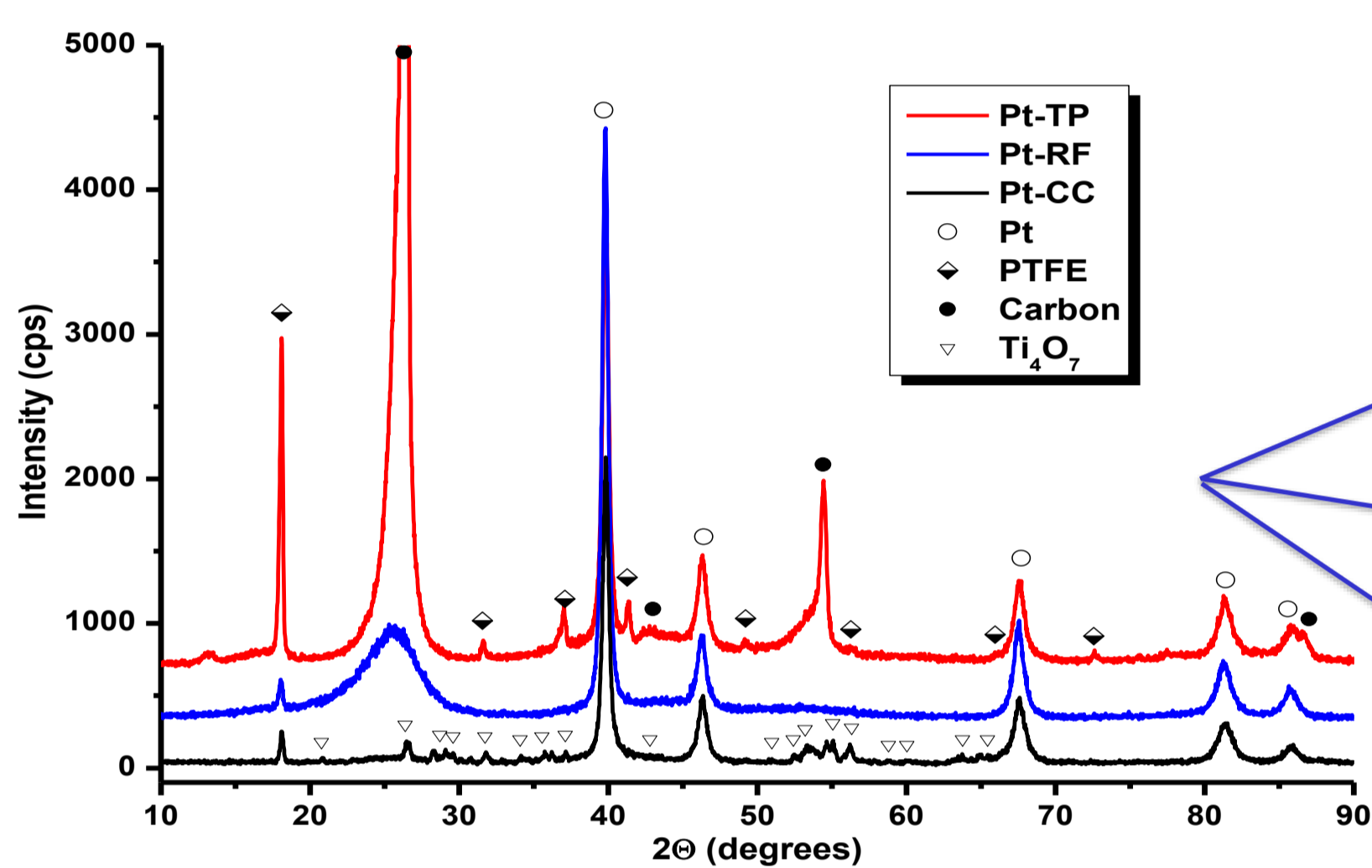
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Introduction:

The electrochemical hydrogen pump is an efficient device for hydrogen cleaning and compression which offers several advantages overall the mechanical compressors such as absence of moving parts, no need for vacuuming and periodical lubrication, possibility to operate at higher differential pressure, etc. However, the technology is still a challenge due to the need of high catalytic loadings of Pt based catalysts for both partial reactions, which makes the system rather expensive. This work presents a newly developed laboratory prototype of electrochemical hydrogen pump/compressor (EHC), operating with proton conductive membrane at differential pressure of up to 5 bar.

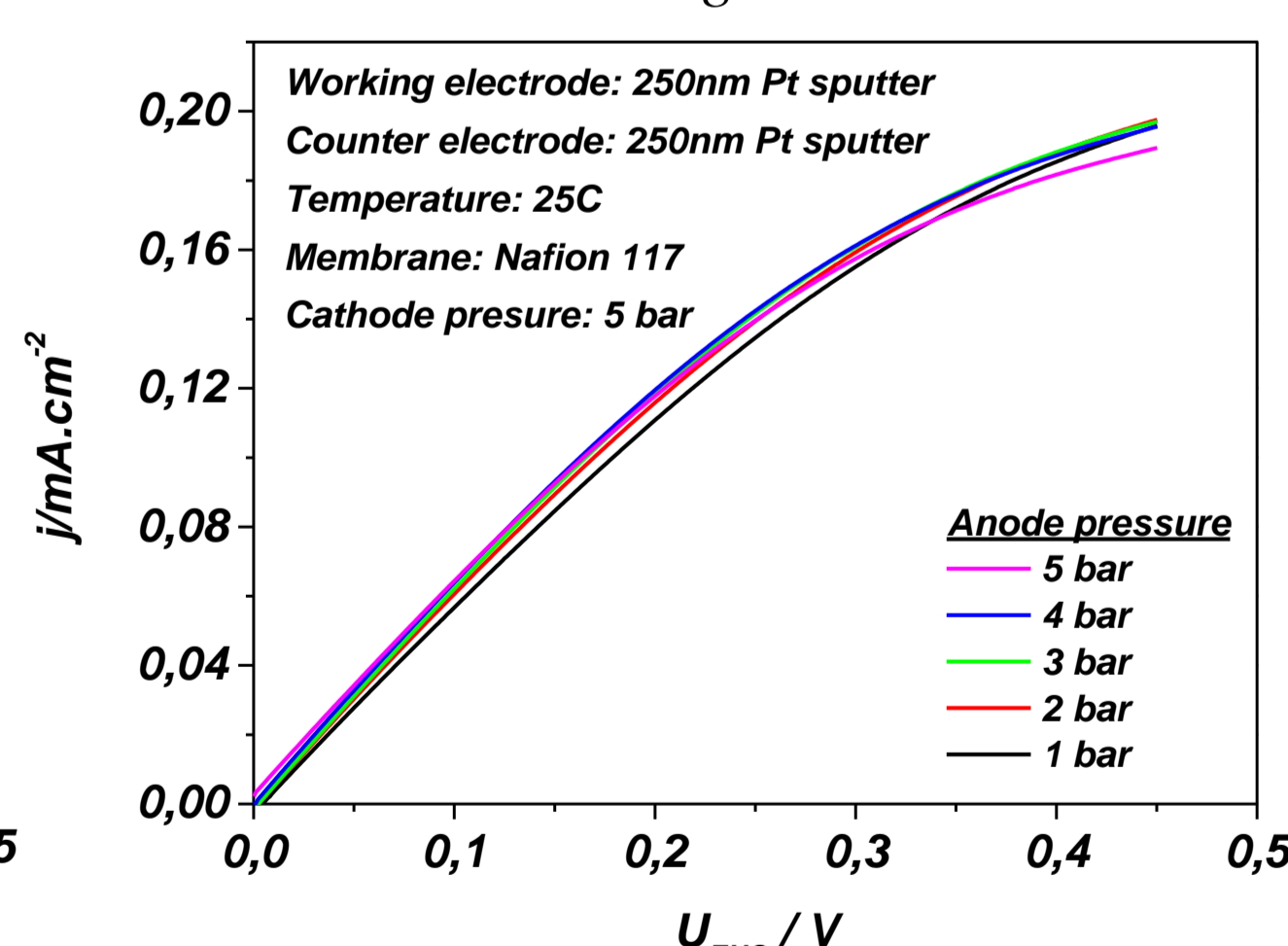
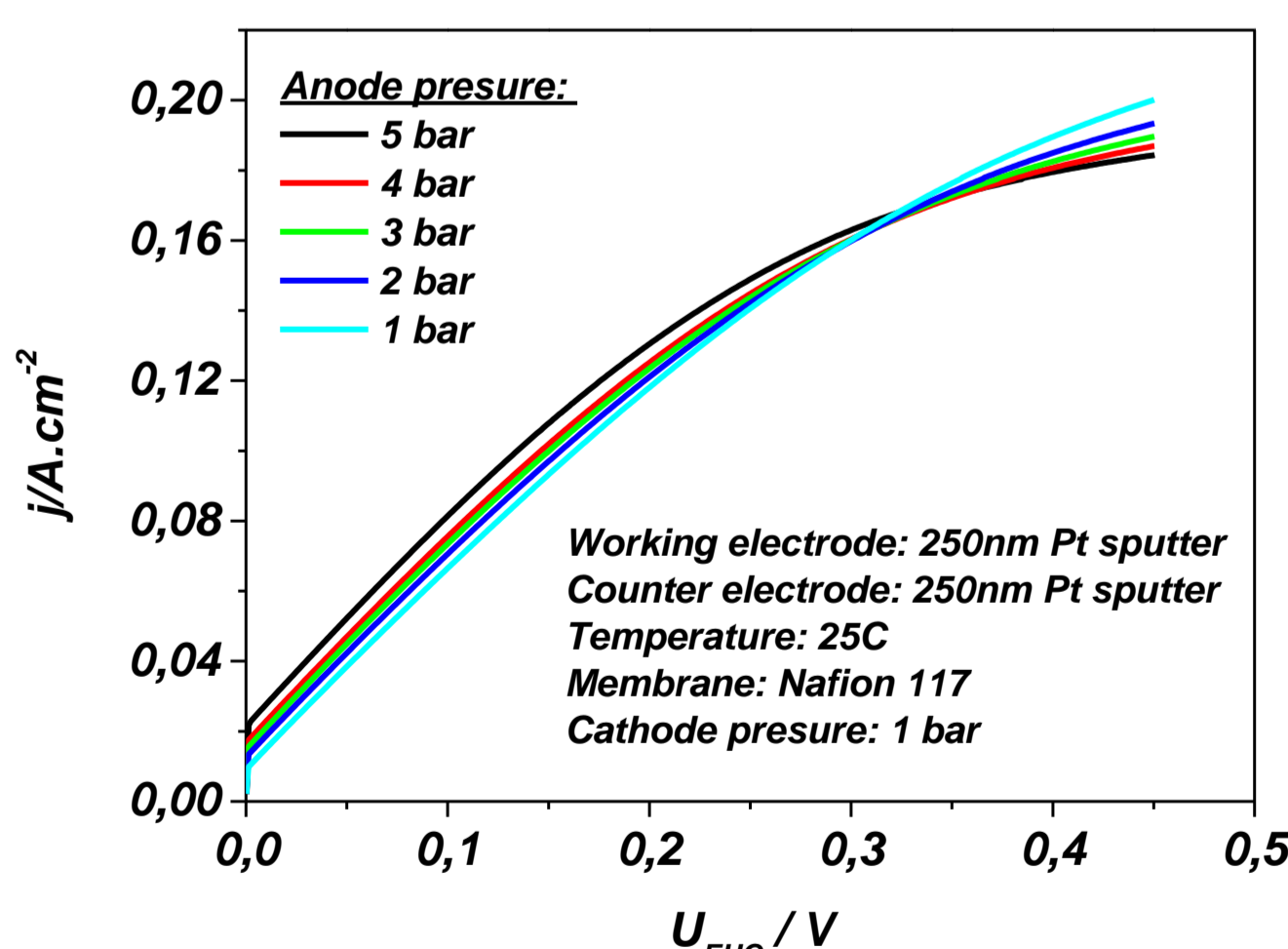
XRD measurements:



Catalyst	Pt crystallites size [nm]	
	$D_{(111)}$	$D_{(200)}$
Pt-RF	20 ± 1	12 ± 2
Pt-TP	20 ± 1	14 ± 2
Pt-CC	21 ± 1	14 ± 2

The XRD spectra's shows crystallographic orientation of the Pt particle mainly (D111) and (D200). The calculated particle size is identical for all prepared samples.

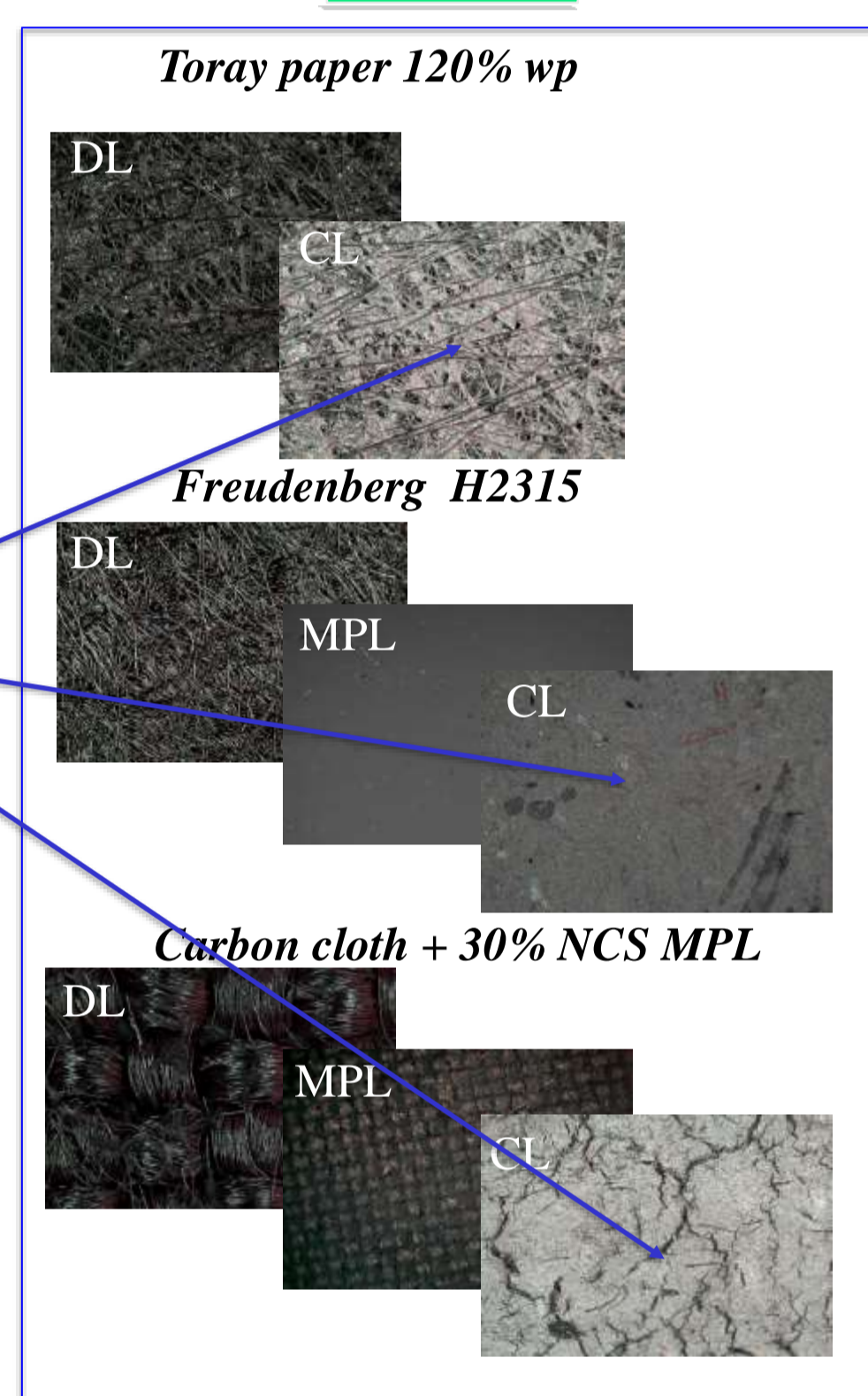
EHC results:



Conclusions:

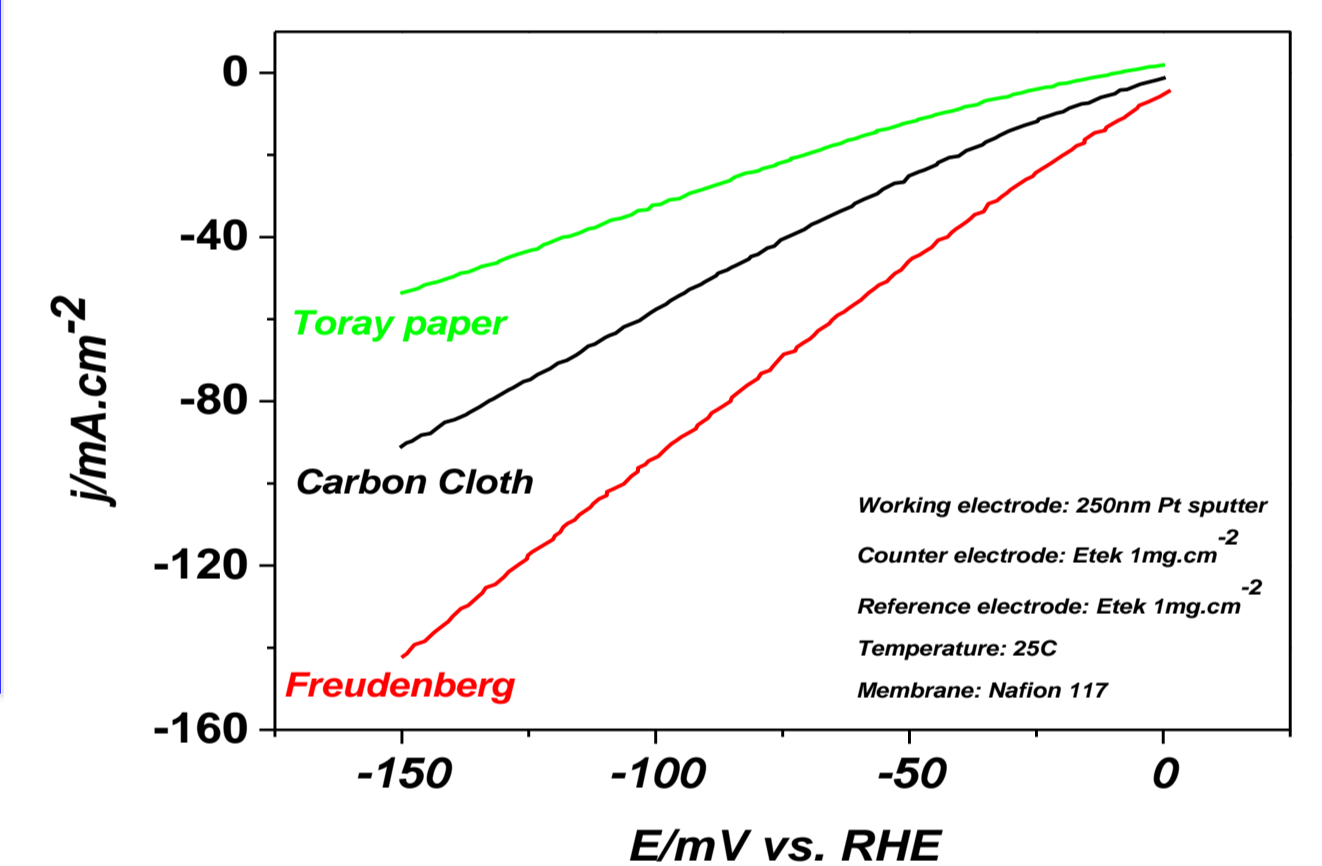
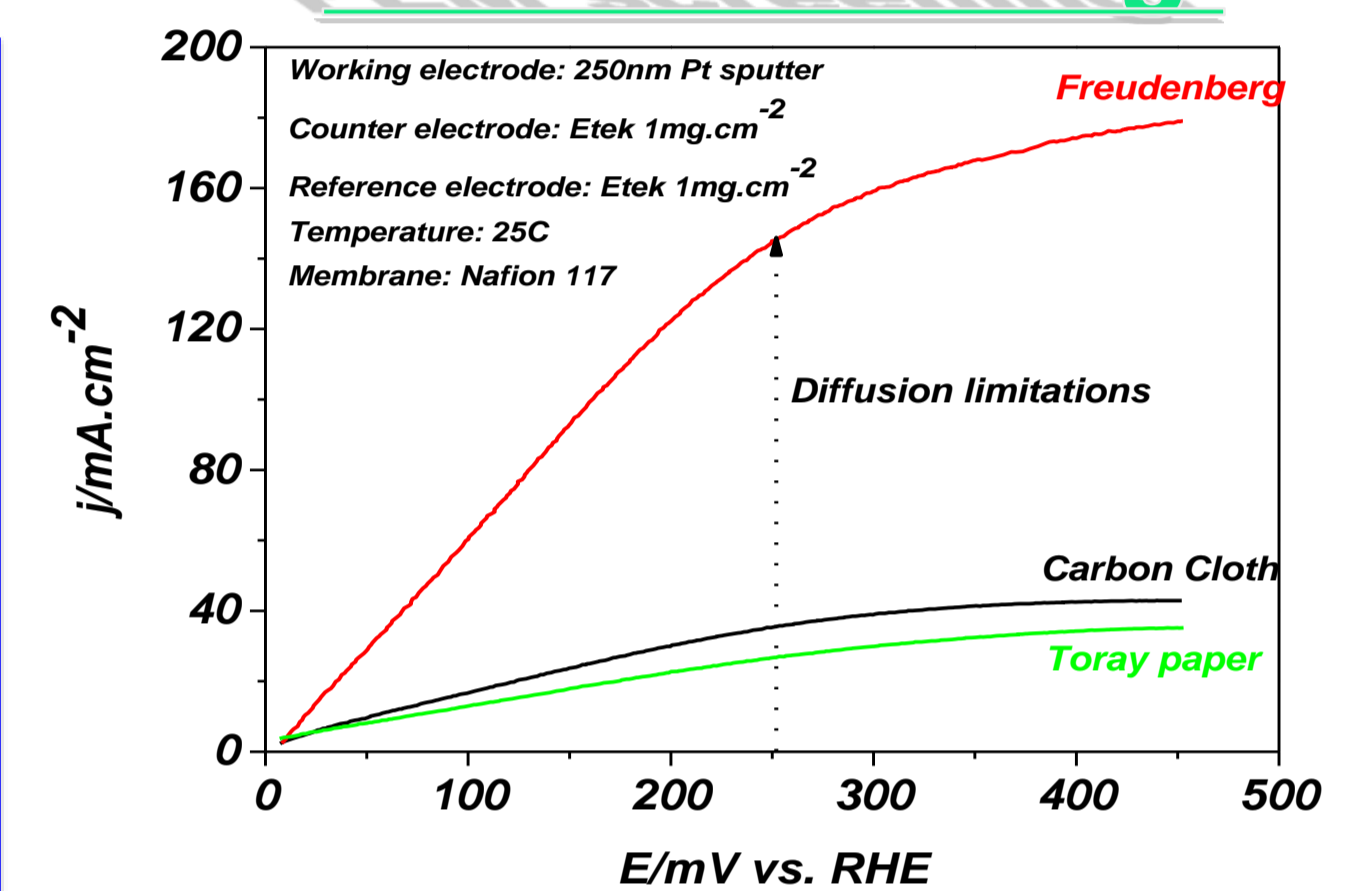
- ✓ The developed electrodes demonstrate possibility to operate in EHC catalysts for both partial reactions in differential pressure of 5 bars.
- ✓ They demonstrate high current density in comparison to the Pt based commercial catalysts ETEK-BASF
- ✓ The amount is reduced 5 times lower and the energy efficiency is improved

GDE:

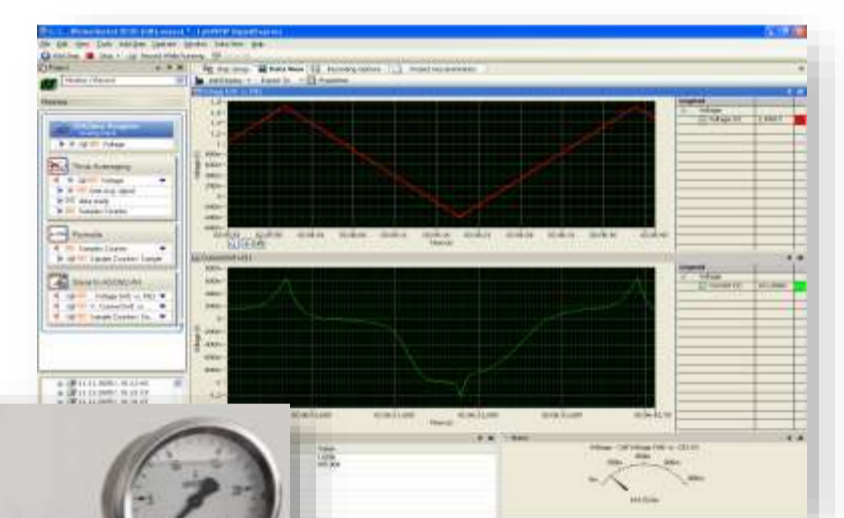


The high current density according both reactions is observed at gas diffusion electrodes based over the Freudenberg.

PEM screening:



Control and measurements Software



EHC Laboratory prototype IEES unit

