PERFLUOROPOLYETHERS AS HYDROPHOBIZING AGENTS FOR FUEL CELLS
CARBONACEOUS FUNCTIONAL MATERIALS

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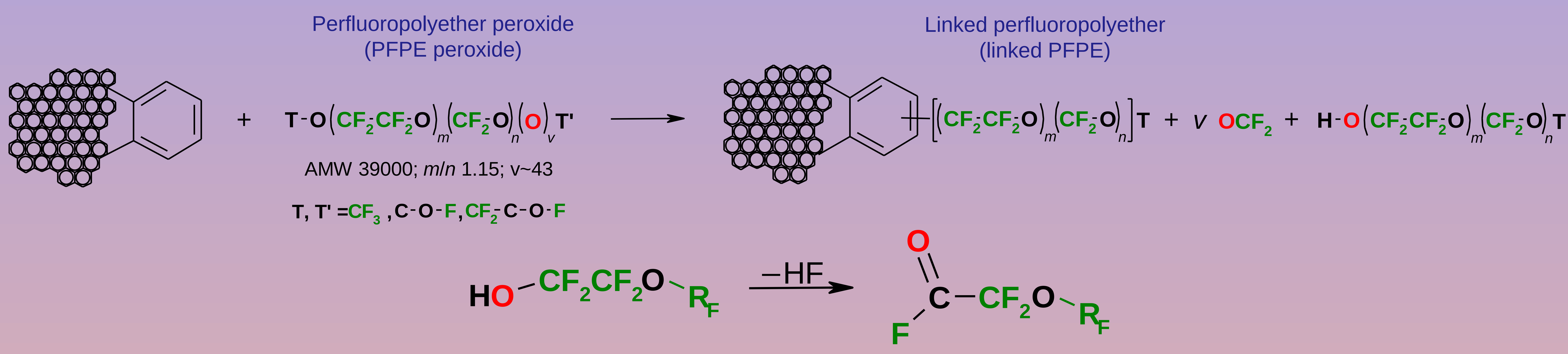


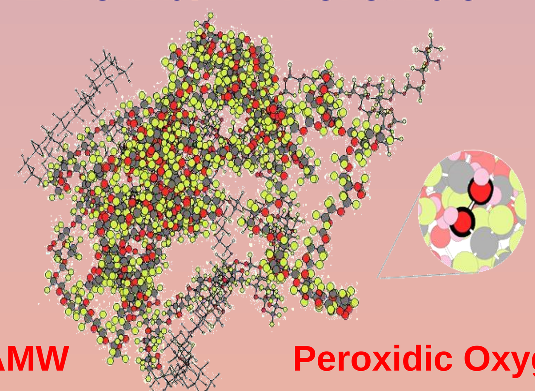
Navarrini, Sansotera, Gola, Bianchi, Wormald, Famulari, Avataneo, *J. Fuorine Chem.*, 2011, 132, 12, 1254-1261

The thermal decomposition of a linear perfluoropolyether peroxide produces perfluoropolyether radicals that link to the unsaturated moieties of carbonaceous materials. The decomposition occurs between 110-200 C and generates radical species with half-life time of 30 mins.

CARBON BLACK

VULCAN XC72R

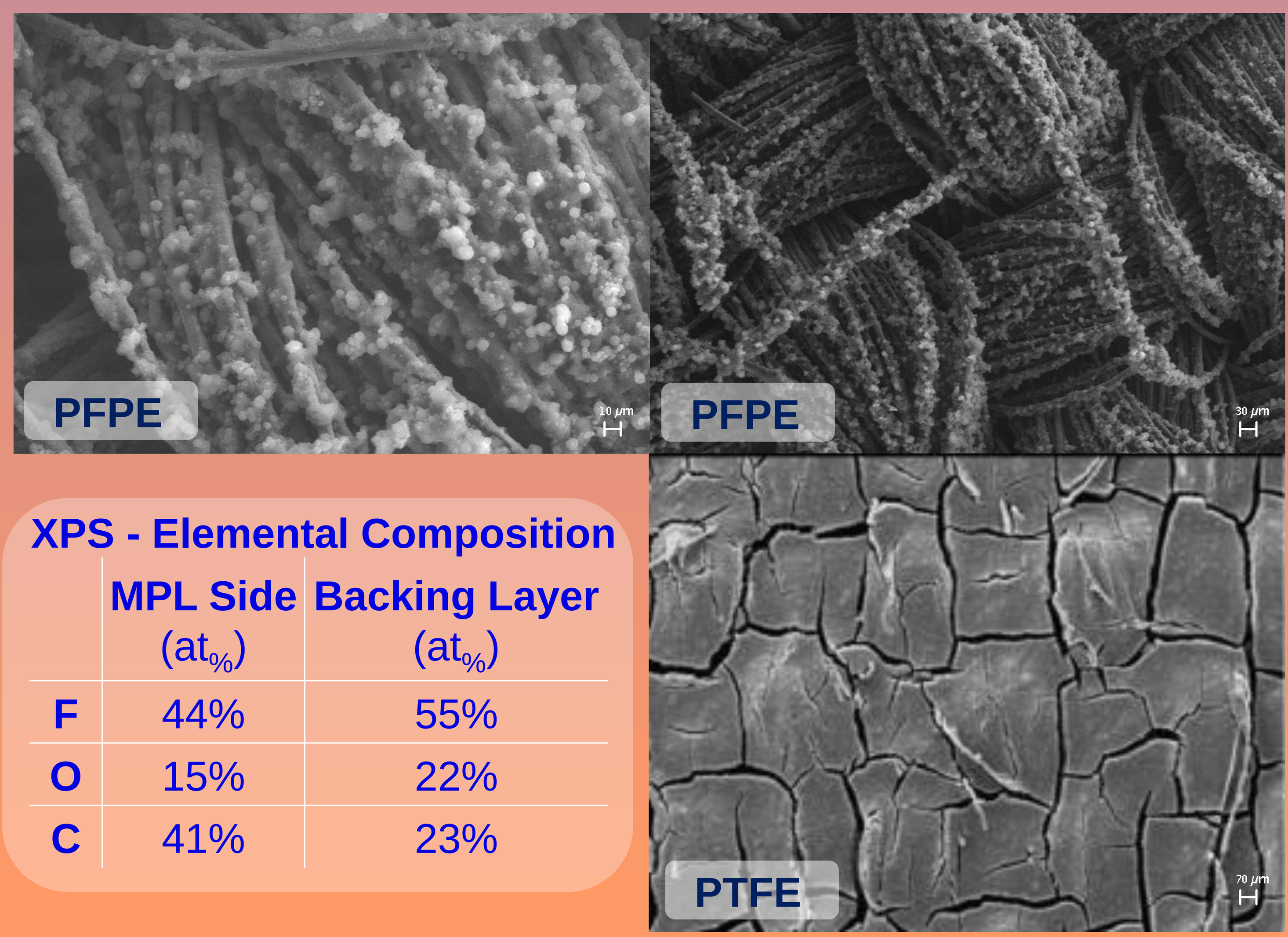
Z-Fomblin® Peroxide



AMW	Peroxidic Oxygen
~39000 u	$1.33\%_{wt}$
C_2/C_1 ratio	Equivalent Weight
1.15	~1200 u

CARBON CLOTH

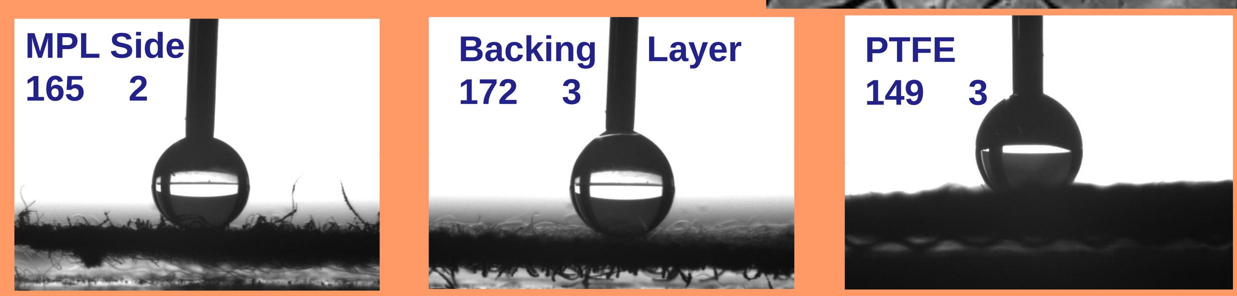
SEAL SGCC5N

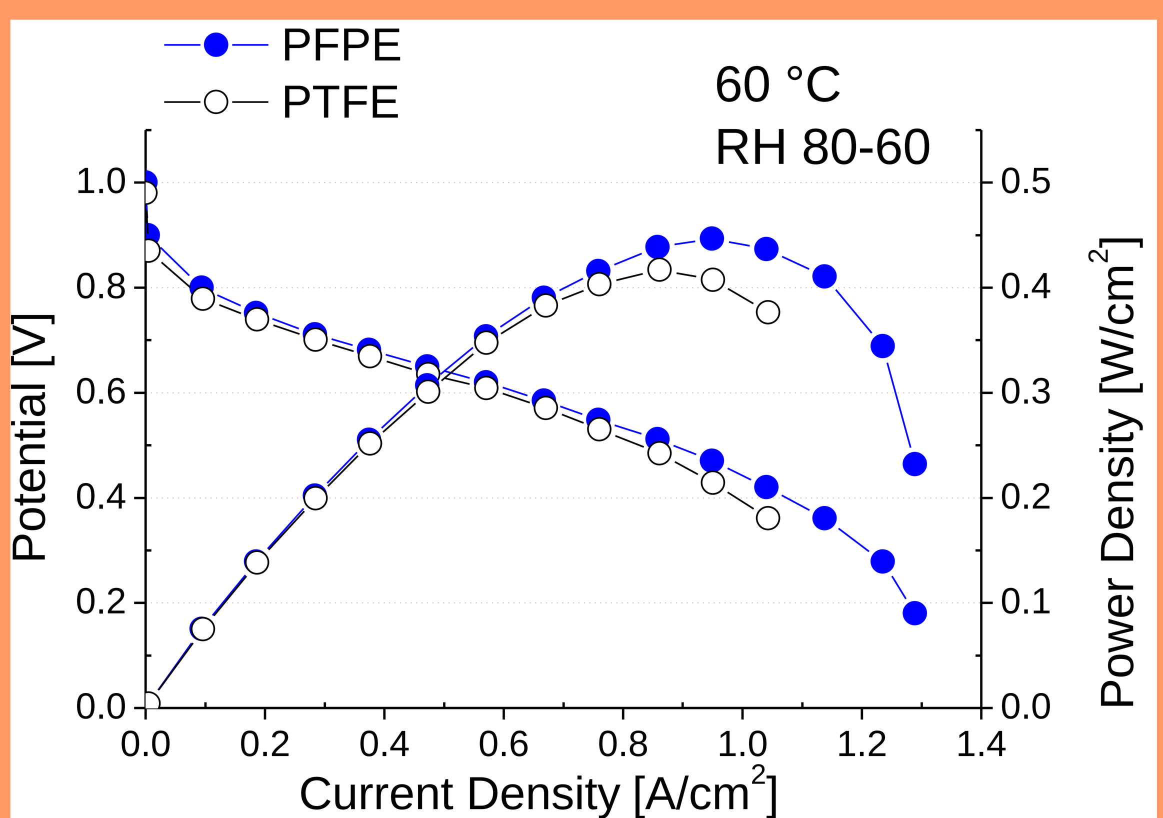


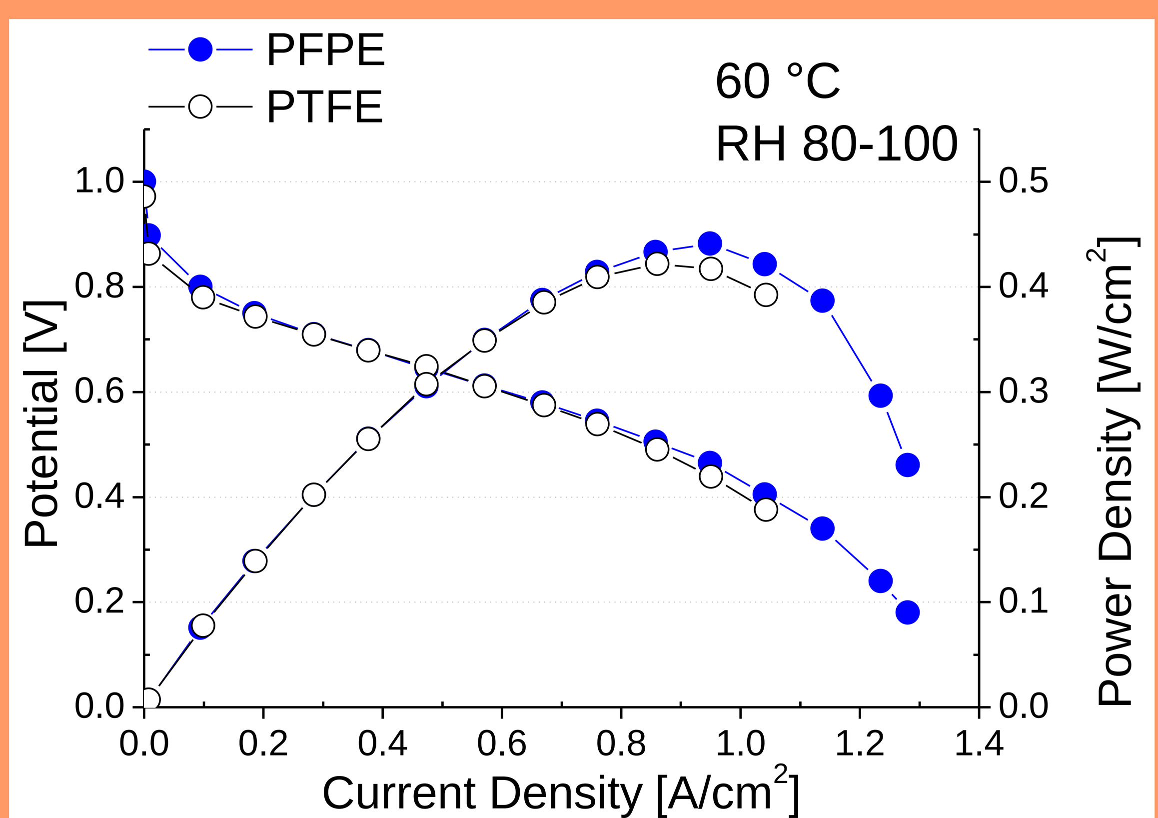
XPS - Elemental Composition

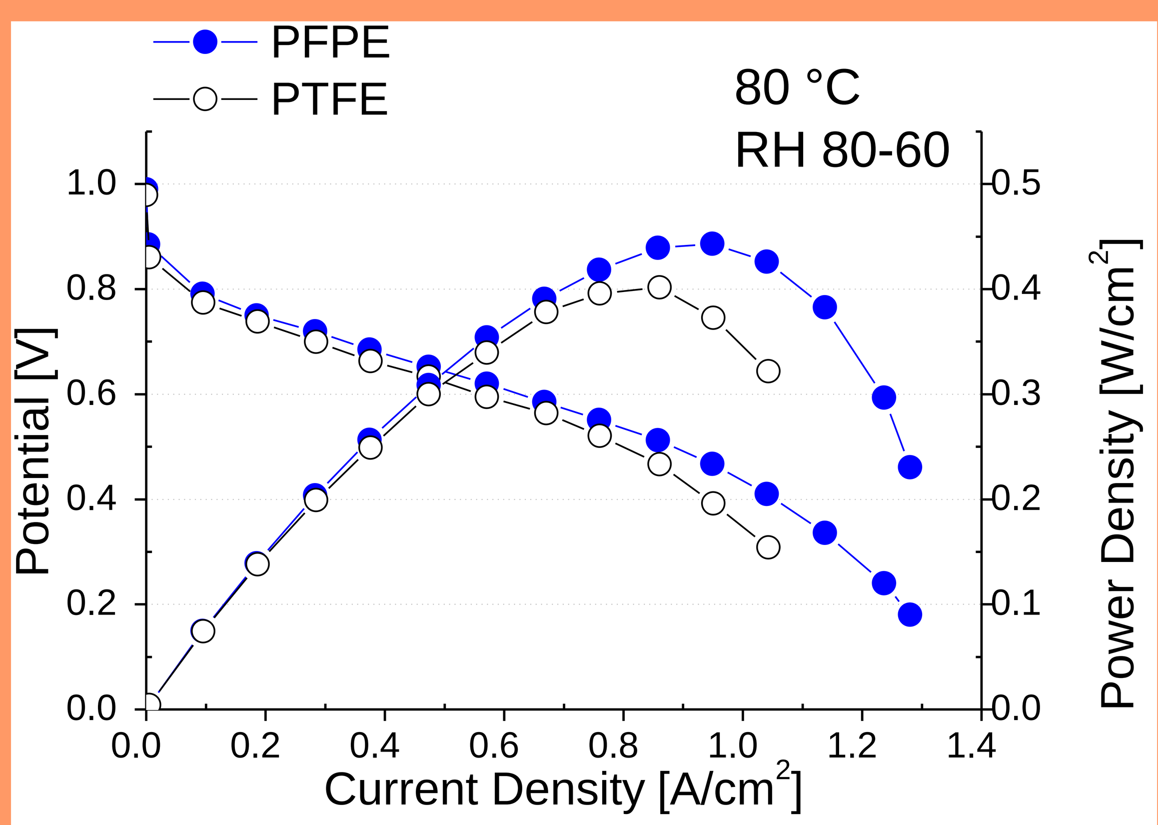
	MPL Side ($at_{\%}$)	Backing Layer ($at_{\%}$)
F	44%	55%
O	15%	22%
C	41%	23%

A ink for microporous layer (MPL) was prepared by dispersing carbon black and perfluoropolyether peroxide (1:1 ratio) in a perfluorinated solvent. The ink was deposited on carbon cloth by spray deposition method.
The peroxide was decomposed between 110-200 C under nitrogen. The fraction of PFPE that did not linked the carbonaceous matrix was removed by washings with perfluorinated solvent. Thereafter, the sample was dipped in a 2% solution of PFPE peroxide and, then, treated between 110-200 C under nitrogen in order to obtain a uniform hydrophobization of the carbon cloth.
$10\%_{wt}$ PFPE was linked to the carbon black for MPL and $1\%_{wt}$ PFPE was linked to the carbon cloth backing layer.

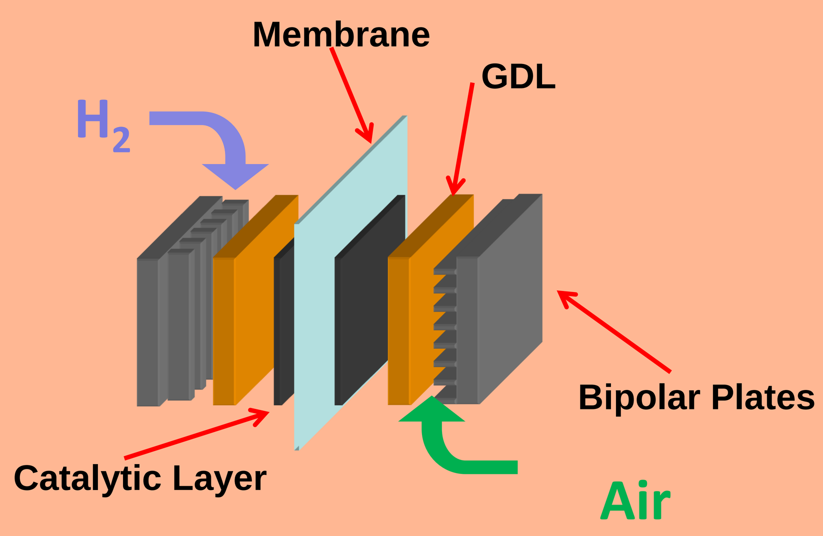








The PFPE GDL was tested in a Polymeric Electrolyte Membrane Fuel Cell (PEMFC) and the results were compared to a standard PTFE-hydrophobized GDL ($10\%_{wt}$ PTFE).



Active area: 25 cm²
Catalyst Coated Membrane: Nafion® 212
Temperatures: 60 C-80 C
R.H: 80%-100%; 80%-60% (Anode-Cathode)
Pt loading: 0.3-0.6 mg/cm² (Anode-Cathode)

Constant flow rate: Air: 1 NL/min
Hydrogen: 0.2 NL/min

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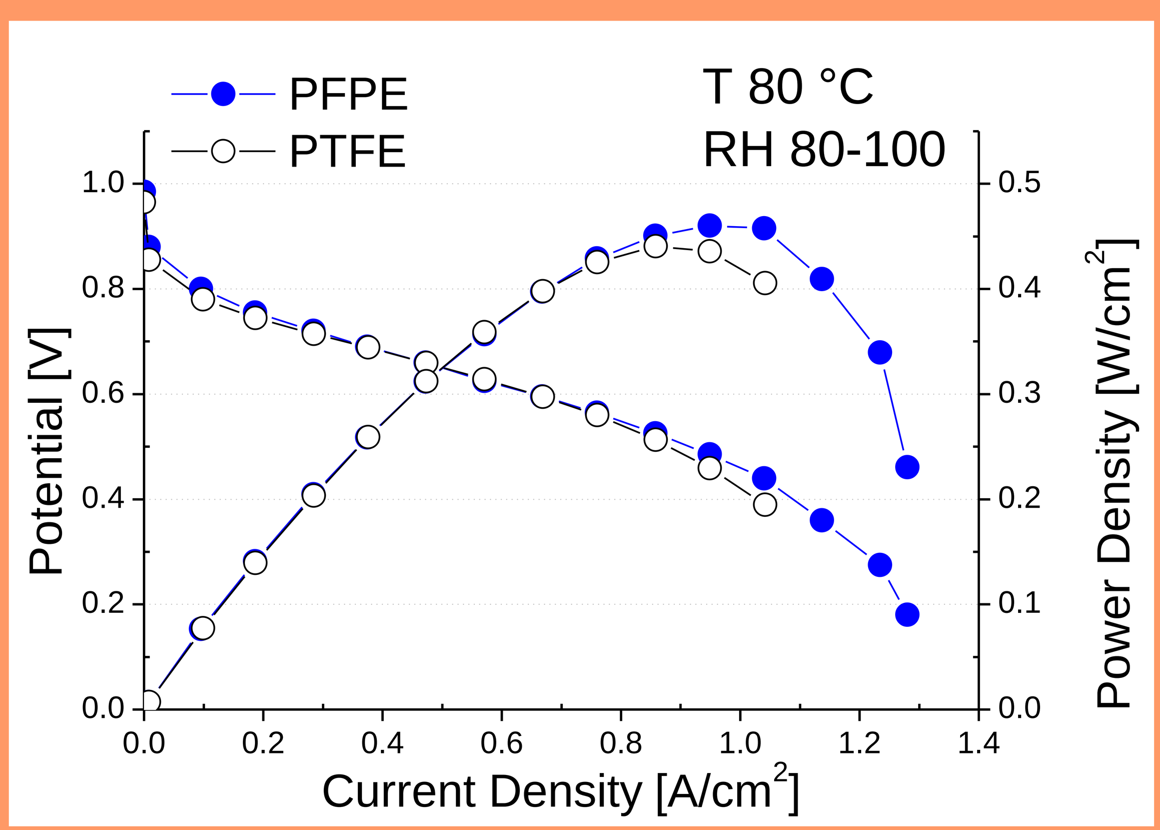

Conclusions

PFPE chains were covalently linked to carbon black and carbon cloth in order to obtain supehhydropobic carbonaceous functional materials. The PFPE-modified carbon-based materials were tested as a Gas Diffusion Layers (GDL) in a PEMFC. Polarization curves showed that PFPE-functionalized materials provided better performances than standard PTFE-hydrophobized ones, especially at high current densities.