



## Durable thin ceramic films for improvement of Proton Exchange Membrane (PEM) electrolysis

Fenini, Filippo; Hendriksen, Peter Vang; Mogensen, Mogens Bjerg

*Published in:*

Book of Abstracts. DTU's Sustain Conference 2015

*Publication date:*

2015

*Document Version*

Publisher's PDF, also known as Version of record

[Link back to DTU Orbit](#)

*Citation (APA):*

Fenini, F., Hendriksen, P. V., & Mogensen, M. B. (2015). Durable thin ceramic films for improvement of Proton Exchange Membrane (PEM) electrolysis. In *Book of Abstracts. DTU's Sustain Conference 2015* Article E-26 Technical University of Denmark.

---

### General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

## Durable thin ceramic films for improvement of Proton Exchange Membrane (PEM) electrolysis

Filippo Fenini\*, Peter Vang Hendriksen, Mogens B. Mogensen  
Department of Energy Conversion and Storage, DTU Risø Campus

\* [filfe@dtu.dk](mailto:filfe@dtu.dk)

The growth of renewable energy production in the latest years has made it essential to find a way to store the excess energy in an efficient and potentially large-scale, easily accessible way. Electrolysis of water can play a key role in this field, since the high purity H<sub>2</sub> produced can be both a powerful energy vector and a multi-purpose synthesis precursor.

One way of producing hydrogen by renewable energy is by using a PEM electrolyser (PEMEC), which is a very compact low temperature electrolyser that allows a fast response to variations in electrical power supply. Moreover, the possibility of operating at high pressure enables a direct production of compressed, storage-ready output gas, thus potentially reducing the overall costs of H<sub>2</sub> production and storage, if the present high cost of the PEMEC can be reduced. The state-of-the-art PEMEC uses an anode based on IrO<sub>2</sub>/RuO<sub>2</sub>, which deliver high catalytic activity and a good corrosion resistance to the high overvoltage conditions necessary for the oxygen evolution reaction (OER) and to the low pH environment due to the membrane. Together with the Ti separator plates, generally coated with precious metals to enhance conductivity, it results in extremely high costs.

Basic material research, to identify and develop low-cost corrosion resistant stack element materials and coatings, is therefore essential. The aim of this project is primarily to identify electronic conducting materials with high chemical stability together with low cost and high availability.

This goal will be reached with extensive testing of electronic conducting ceramics in strongly oxidizing and acid environment, simulating the OER conditions in a real cell. Moreover, the evaluation of the real potential and pH experienced *in operando* by the anode material will be targeted, for properly tuning of the testing conditions. After this first screening stage, the most promising candidates will be further tested by measurement of their conductivity and other physical properties.

In a second stage of the project, the conductive and corrosion resistant materials will be deposited in thin films onto the cell electrodes; the interconnection and the adhesion between films will be object of great attention. The materials can be deposited by mean of several techniques such as PVD, RF-sputtering and PLD. The thin films will be investigated using electric conductivity, electron microscopy and x-ray photoelectron spectroscopy (XPS) and possibly other physical and chemical methods.