**Motivation**

Hydrogen as a storage medium for renewables

- Wind
- Solar
- Excess of Electricity
- H₂ generation
- Storage medium
- PEM electrolysis
- Alkaline electrolysis
- Gas grid
- Methane
- Power-to-Gas
- Liquid fuel
- Power-to-Fuels

PEM electrolysis is the platform for large scale H₂ production from renewable energy thanks to its rapid response under dynamic operation and high specific energy density.

**Approach**

**System**
- Degradation analysis with segmented cell and test units systems
- 20 kWₑ test station

**Modelling**
- 25-50 kWₑ test station
- Heat exchange:
  \[
  \frac{dE}{dt} + (\frac{dE}{dl}) + \frac{\partial E}{\partial l} = \frac{\partial E}{\partial T}
  \]
- Stack voltage:
  \[
  E(T) = l_p(T) + \frac{R}{2n^2 T^2 F^2} + \frac{1}{2 n F} \frac{1}{2 F} + K_{cell}(T)
  \]

**Corrosion protection**
- Dense coatings of Ti or low cost electro-ceramics for corrosion protection of stainless steel bipolar plates
- Vacuum thermal spraying facility (coatings on surfaces > 2 m²)

**Catalysts**
- R&D of cost effective catalyst with reduced PMG content, meeting the following requirements:
  - Activity: > 6.6 A/g
  - Durability: < 21% ad*
  - Cost: < 100 €/g
  - Availability: > 1 g/day
- Characterisation techniques such as XRD, SEM, XPS and RDE are being used. CCMs with novel catalysts are tested in the 20 kWₑ test station

**Results**

**System**
- Electrolyser container for gas station in Stuttgart (expected mid 2014)
- 25-50 kWₑ PEM electrolyser

**Modelling**
- An accelerated stress test (AST) protocol has been conceived based on wind energy input
- Developed thermal spraying Ti coatings protect the stainless steel substrate from corrosion

**Catalysts**
- State of the art catalysts have been screened in simulated environment
- Developed thermal spraying Ti coatings protect the stainless steel substrate from corrosion

**Collaboration:**