

MODULO: CHIMICA SOSTENIBILE

Winter school 12-16 Febbraio 2018

Referenti:

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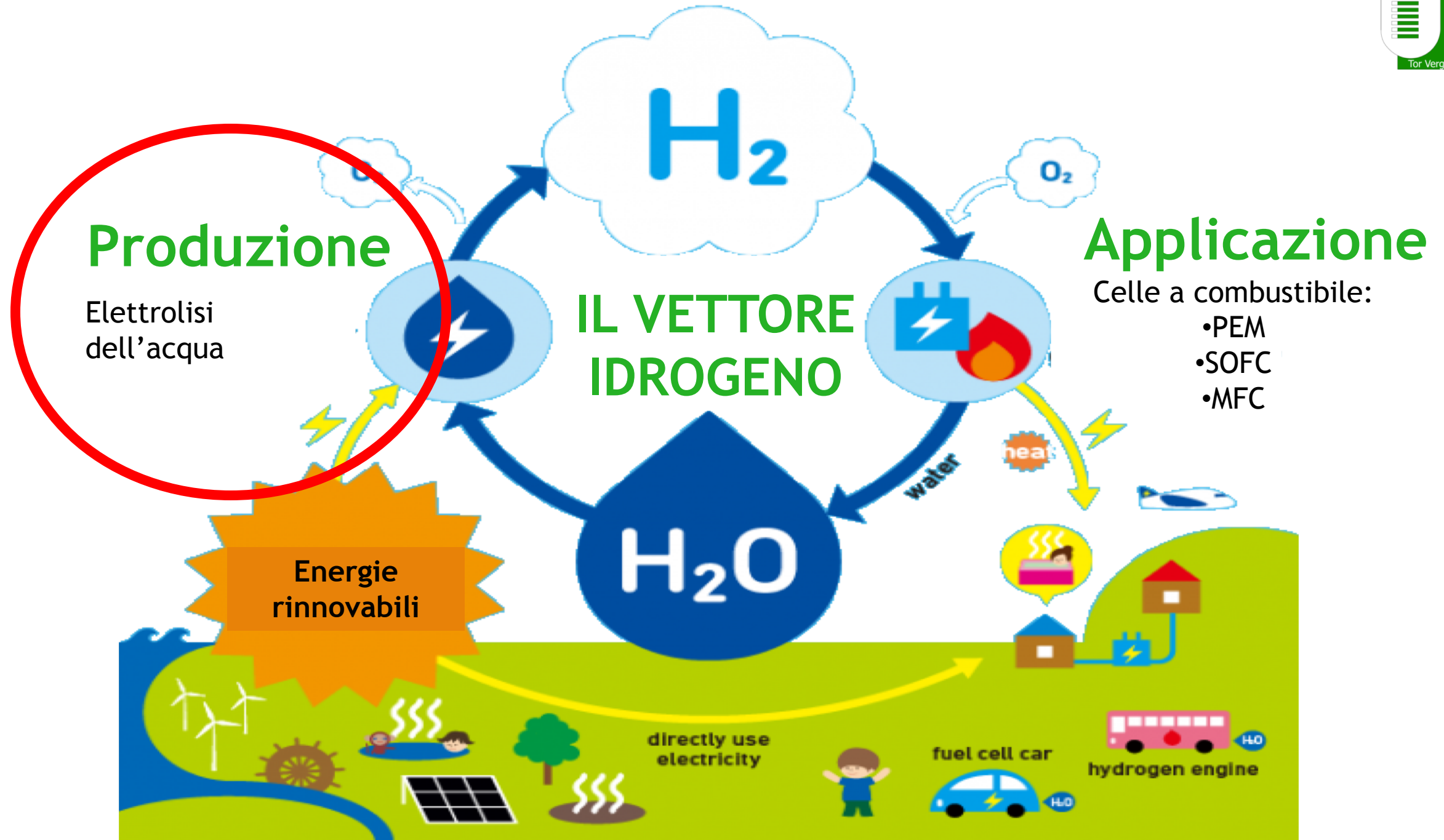
Il problema dell'energia

Le risorse energetiche che attualmente utilizziamo sono limitate, l'obiettivo è trovare un modo alternativo di produzione attraverso **fonti rinnovabili**:

- Energia geotermica
- Energia eolica
- Energia idroelettrica
- Energia solare
- Biomasse

• **Vettore idrogeno**





Elettrolisi dell'acqua

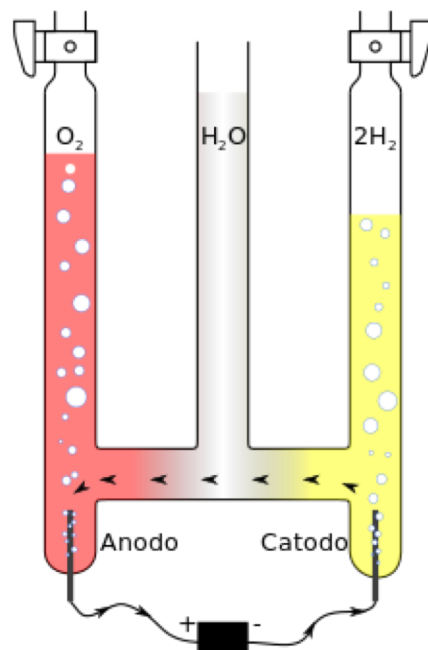
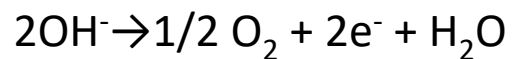
L'elettrolisi è un processo di ossidoriduzione che prevede la trasformazione:

Energia elettrica

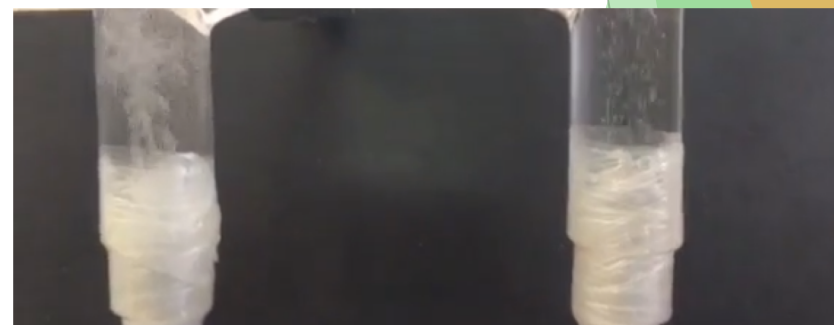
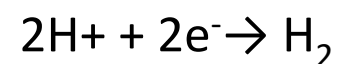


Energia chimica

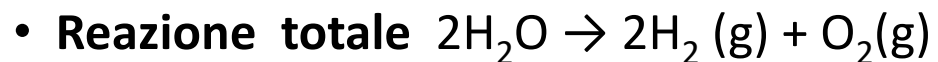
- **Ossidazione**

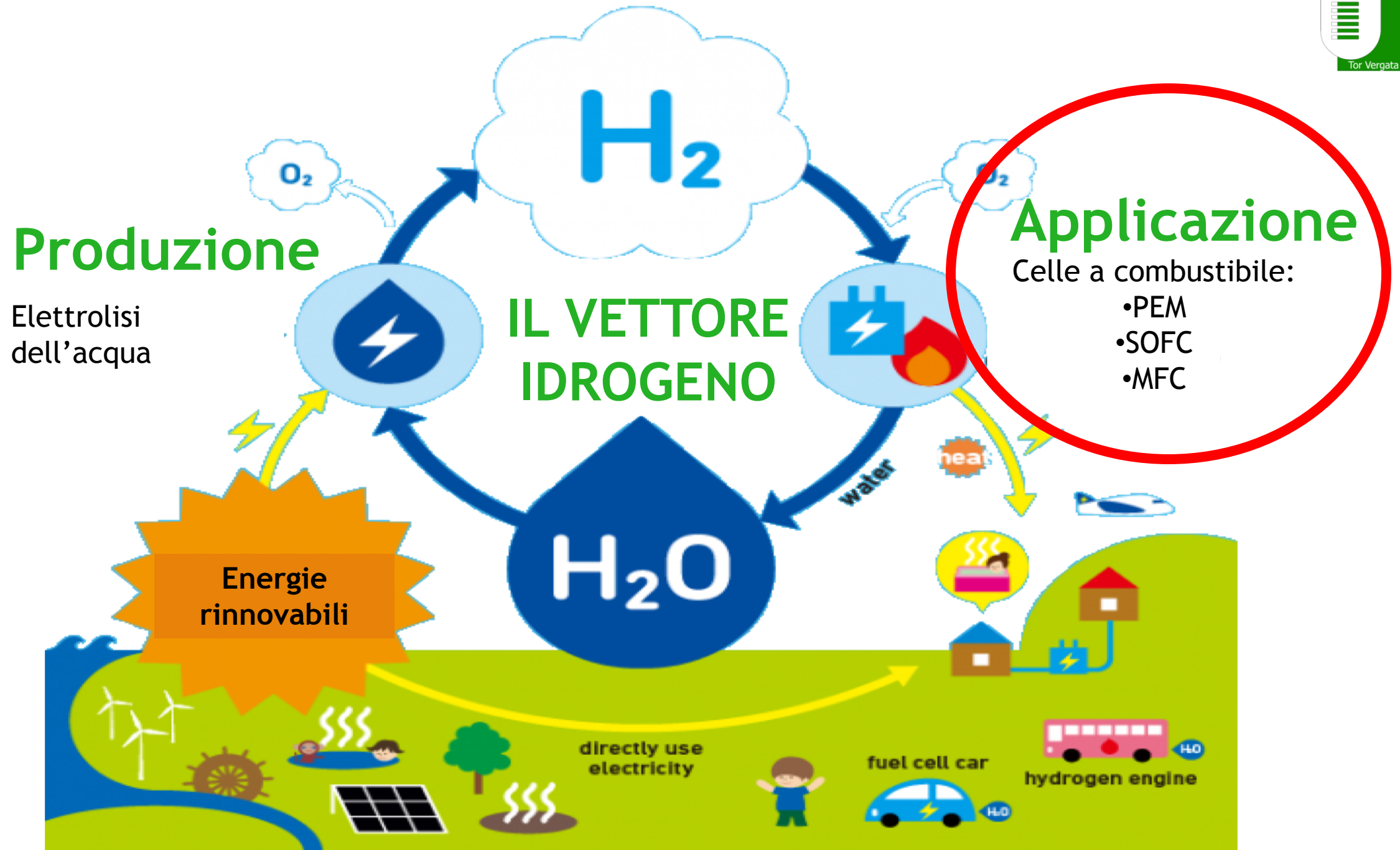


- **Riduzione**



Esperimento in laboratorio

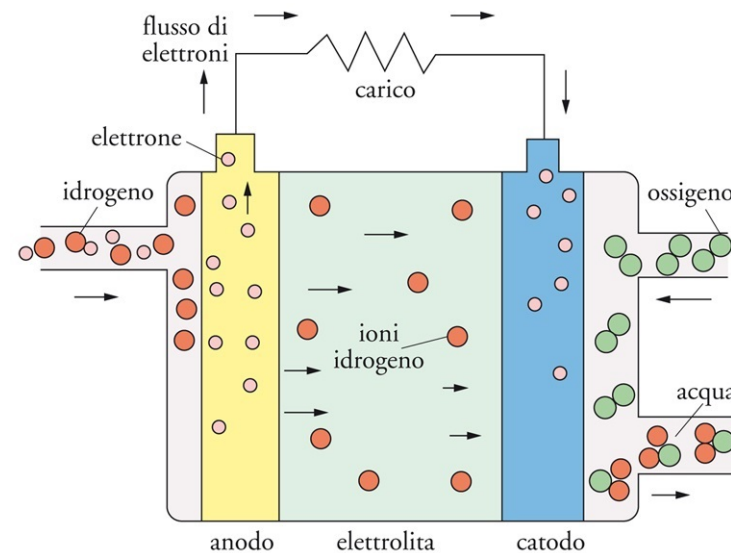




Celle a combustibile

Dispositivo elettrochimico per
Energia chimica  Energia elettrica

- **Ossidazione**
 $\text{H}_2 \rightarrow 2\text{H}^+ + 2\text{e}^-$



- **Riduzione**
 $\frac{1}{2} \text{O}_2 + 2\text{H}^+ + 2\text{e}^- \rightarrow \text{H}_2\text{O}$

- **Reazione totale** $2\text{H}_2 (\text{g}) + \text{O}_2 (\text{g}) \rightarrow 2\text{H}_2\text{O}$

Classificazione celle a combustibile

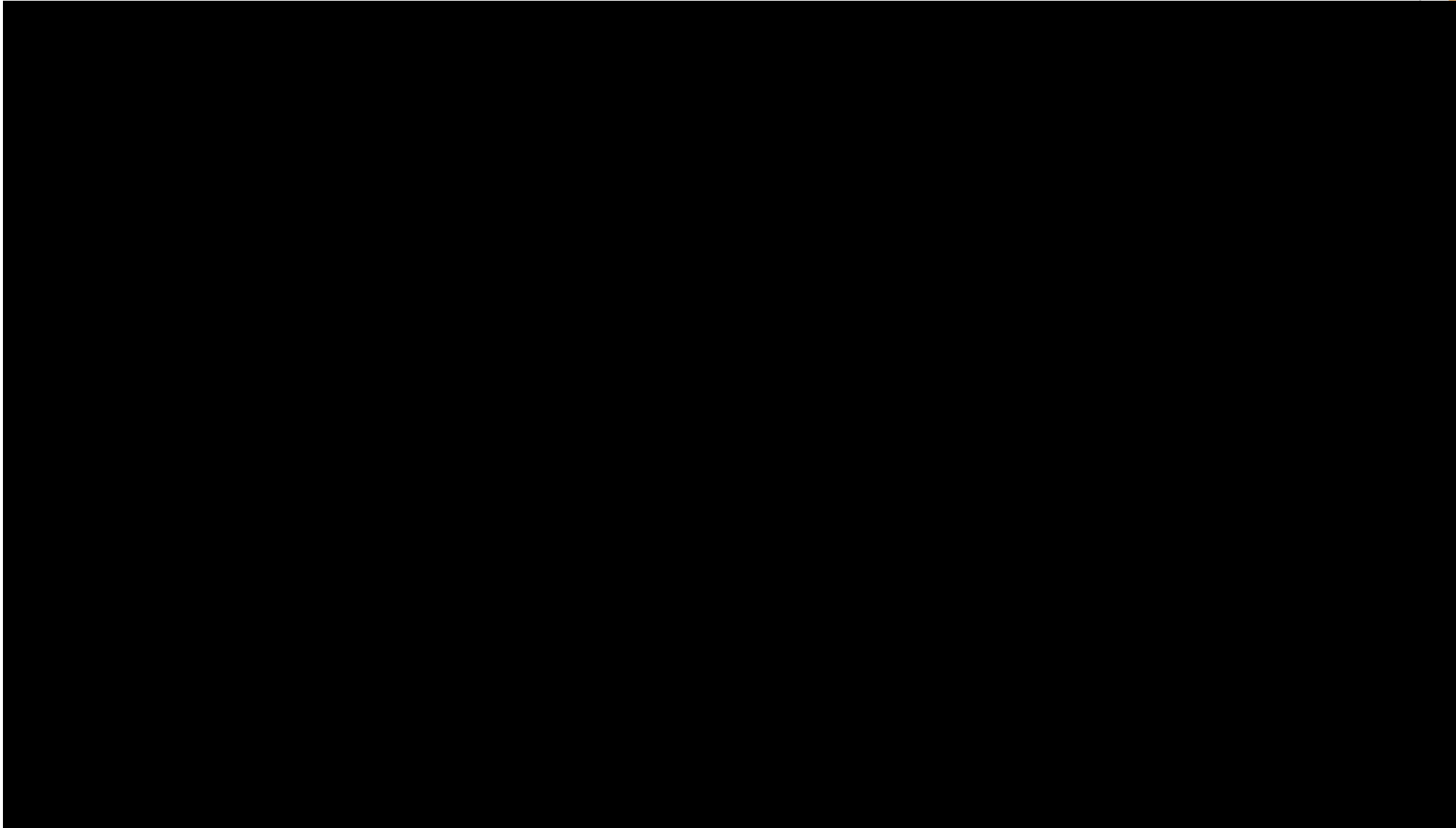
PEM

SOFC

MFC

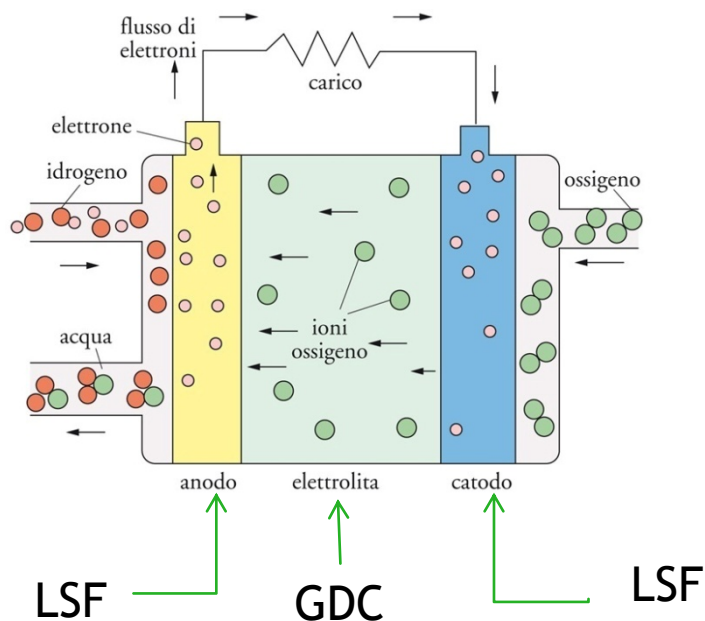


Applicazione di una cella a combustibile: macchina ad idrogeno



SOFC: Solid Oxide Fuel Cells

Celle a combustibile ad ossidi solidi



Componenti: ossidi solidi (materiali ceramici)

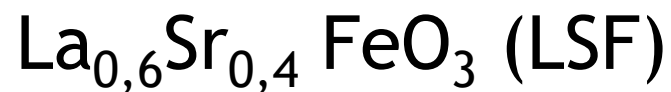
- elettrodi (LSF)
- elettrolita (GDC)

Condizioni di lavoro

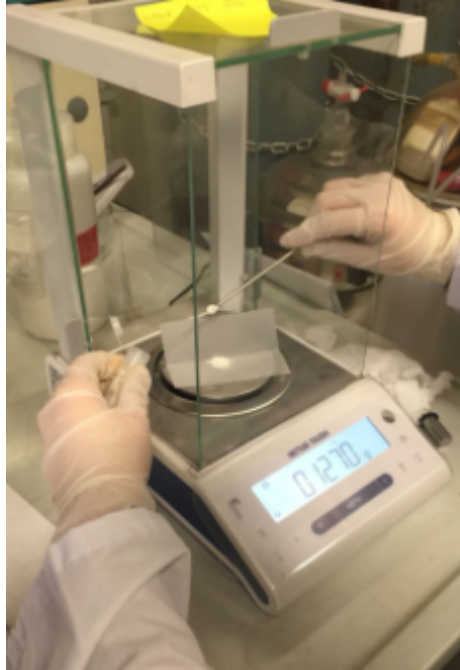
- alte temperature (600° C- 1000° C)
- combustibile: H₂ gassoso

In laboratorio:

Sintesi della PEROVSKITE (elettrodo)



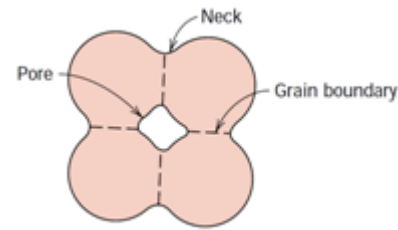
SOFC: Elettrolita (GDC)



Preparazione elettrolita denso
 $\text{Ce}_{0,9}\text{Gd}_{0,1}\text{O}_2$ (GDC-gadolinia doped ceria)

Preparazione

- *pesatura*
- *pressatura*
- *sintering* (1500°C)



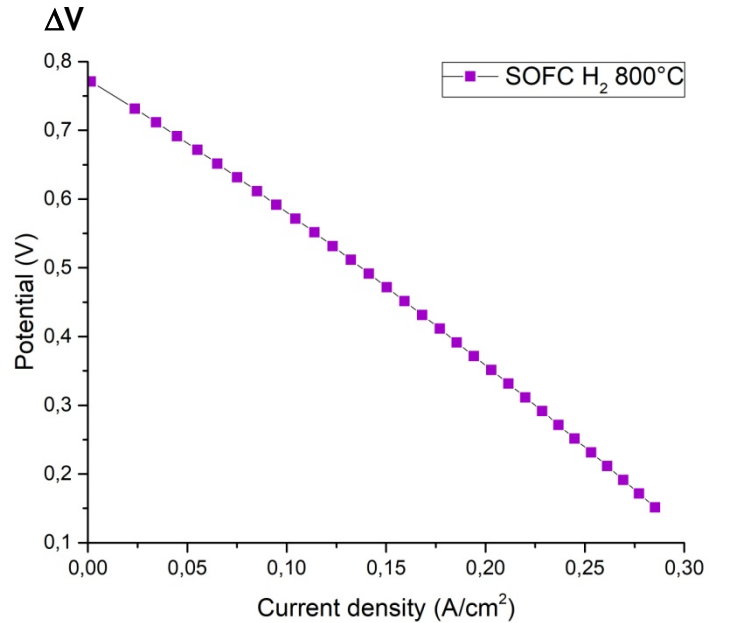
Caratterizzazione

- *misura diametro*
- *misura spessore*
- *calcolo densità*

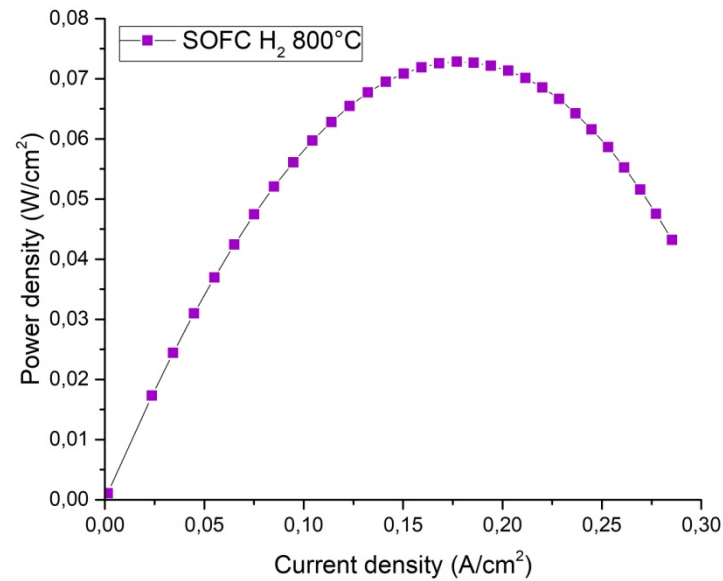


SOFC: test della cella

Alimentazione: H_2 - temperatura di esercizio $800^\circ C$

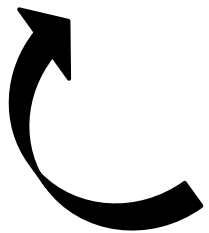
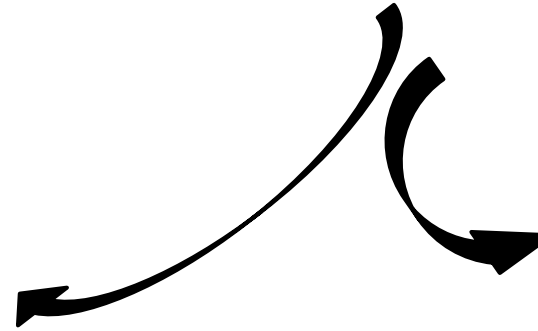
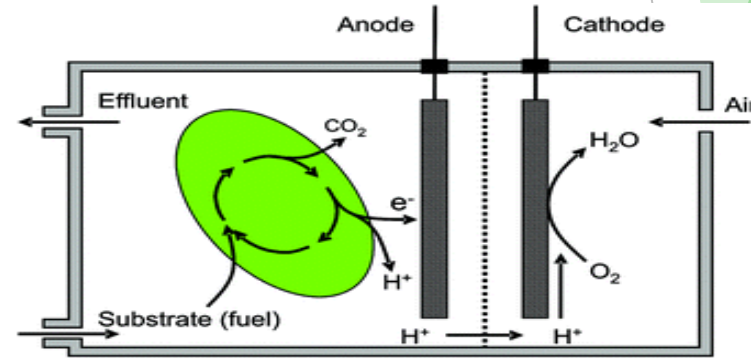
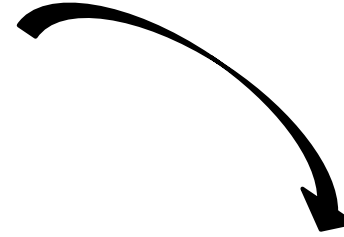


Corrente e tensione
della cella

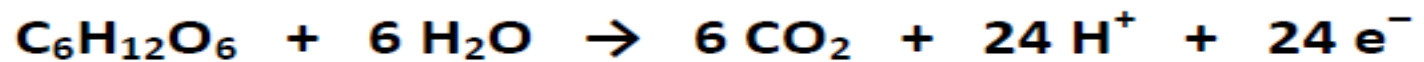
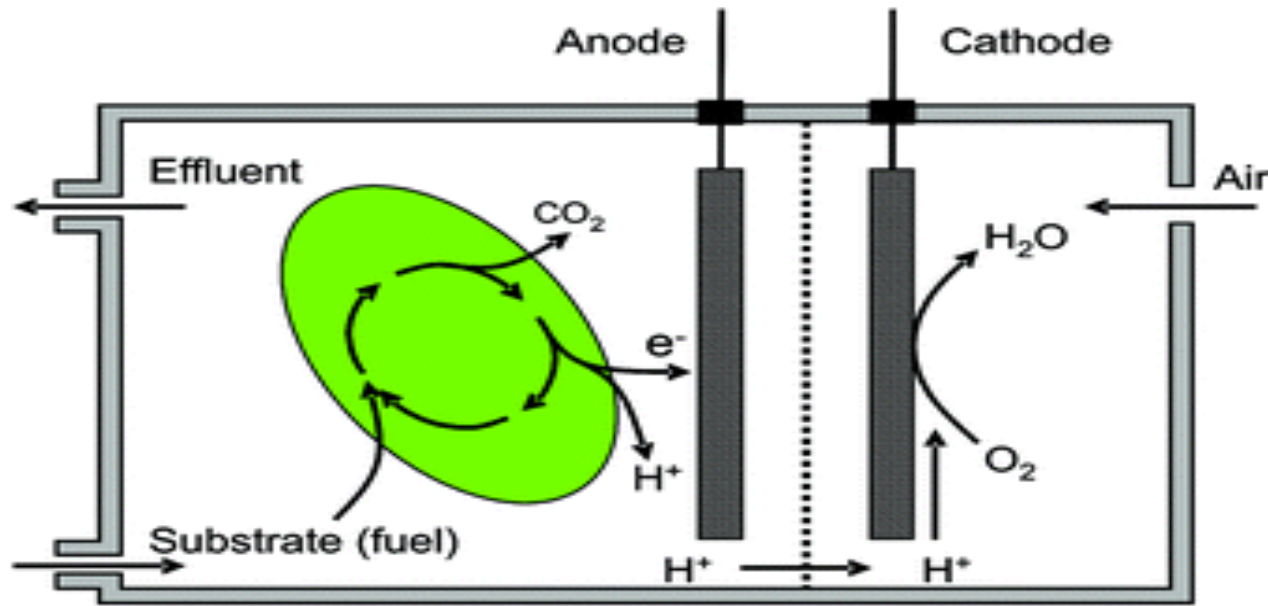


Potenza della cella

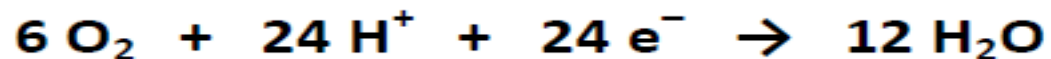
Celle a Combustibile Microbiche



Celle a Combustibile Microbiche



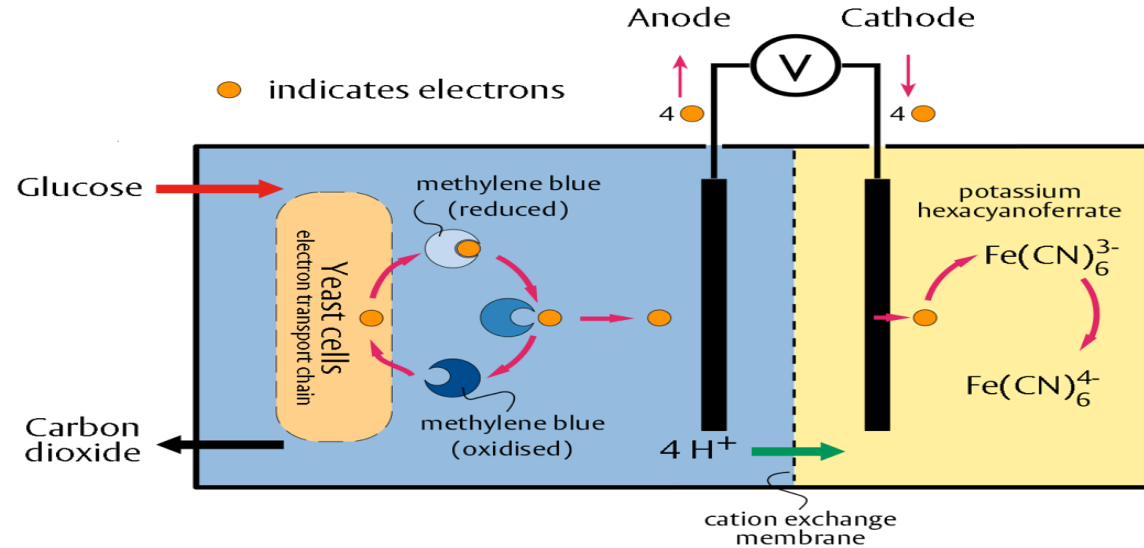
Anodo, ossidazione



Catodo, riduzione



Celle a Combustibile Microbiche

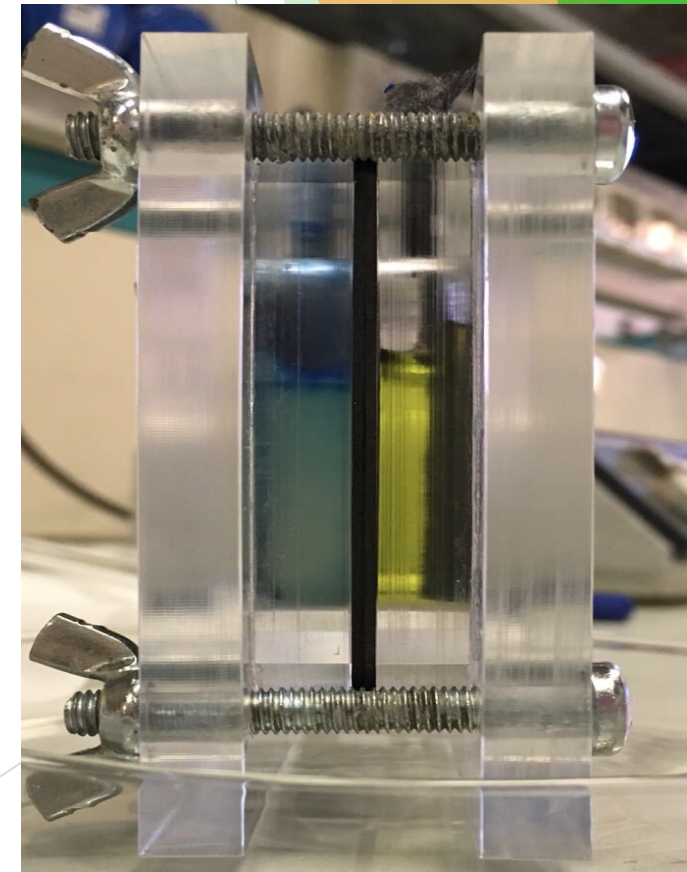
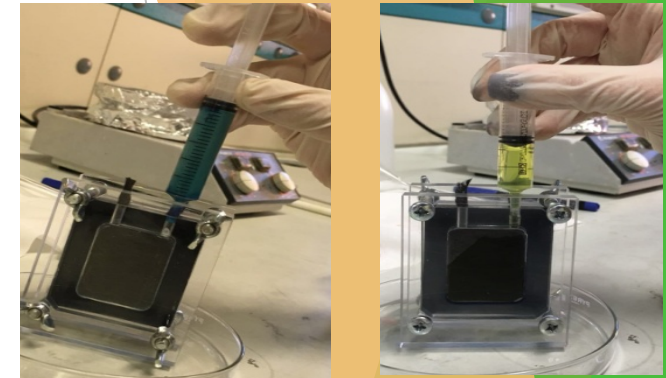


• LATO ANODICO

- Glucosio 1M
- Blu di Metilene 0,01M
- Lievito di birra

• LATO CATODICO

- Esacianoferrato 0,02M

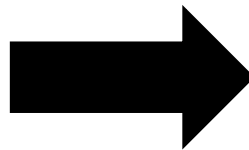
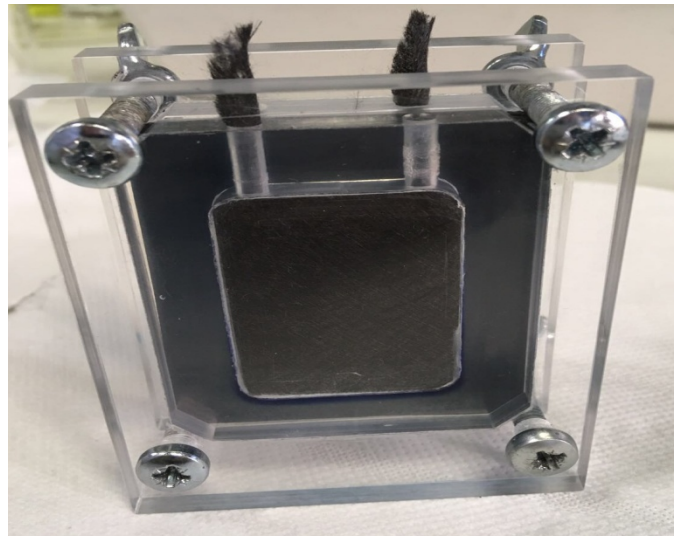
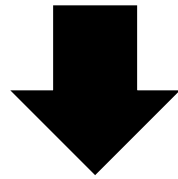


Componenti di una MFC



Elettrodi: Carbon Paper

Membrana polimerica



Differenza di potenziale



*Grazie
per l'attenzione!!!*

Saluti



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