

The image is a composite. The left side shows a family of three—a woman in the foreground with long brown hair and a white scarf, and two children behind her—looking towards the right. The right side shows two female scientists in white lab coats and safety glasses working on a complex piece of electronic equipment with many wires in a laboratory setting.

RESEARCH, DEVELOPMENT and **INNOVATION**,
for **IMPROVING PEOPLE'S LIFE**



HIDROGÊNIO E AS TECNOLOGIAS DE CÉLULAS A COMBUSTÍVEL

Apresentação para o Conselho de Energia - Curitiba, 14/06/2023



Fontes e cores do Hidrogênio

Cor
Hidrogênio PRETO/MARROM

Processo
Gaseificação

Fonte
Carvão

Cor
Hidrogênio CINZA

Processo
SMR ou gaseificação

Fonte
Metano ou carvão

Nota: SMR = reforma a vapor do metano.

Cor
Hidrogênio AZUL

Processo
SMR ou gaseificação com captura de carbono (85-95%)

Fonte
Metano ou carvão

Nota: SMR = reforma a vapor do metano.

Cor
Hidrogênio TURQUESA

Processo
Pirólise

Fonte
Metano

Cor
Hidrogênio VERDE

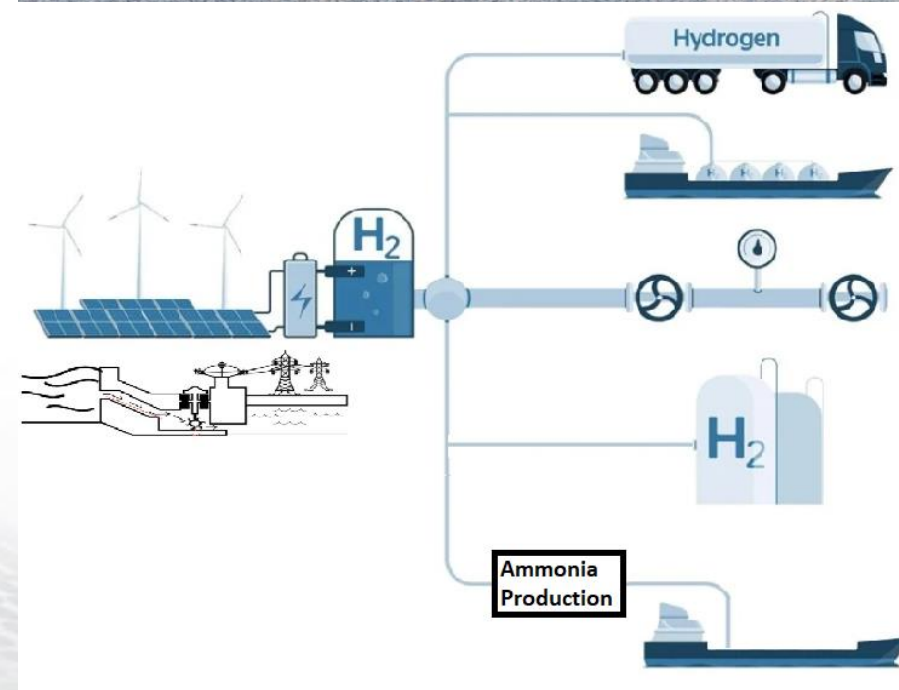
Processo
Eletrólise

Fonte
Eleticidade renovável

Cor
Hidrogênio ROSA

Processo
Eletrólise

Fonte
Nuclear

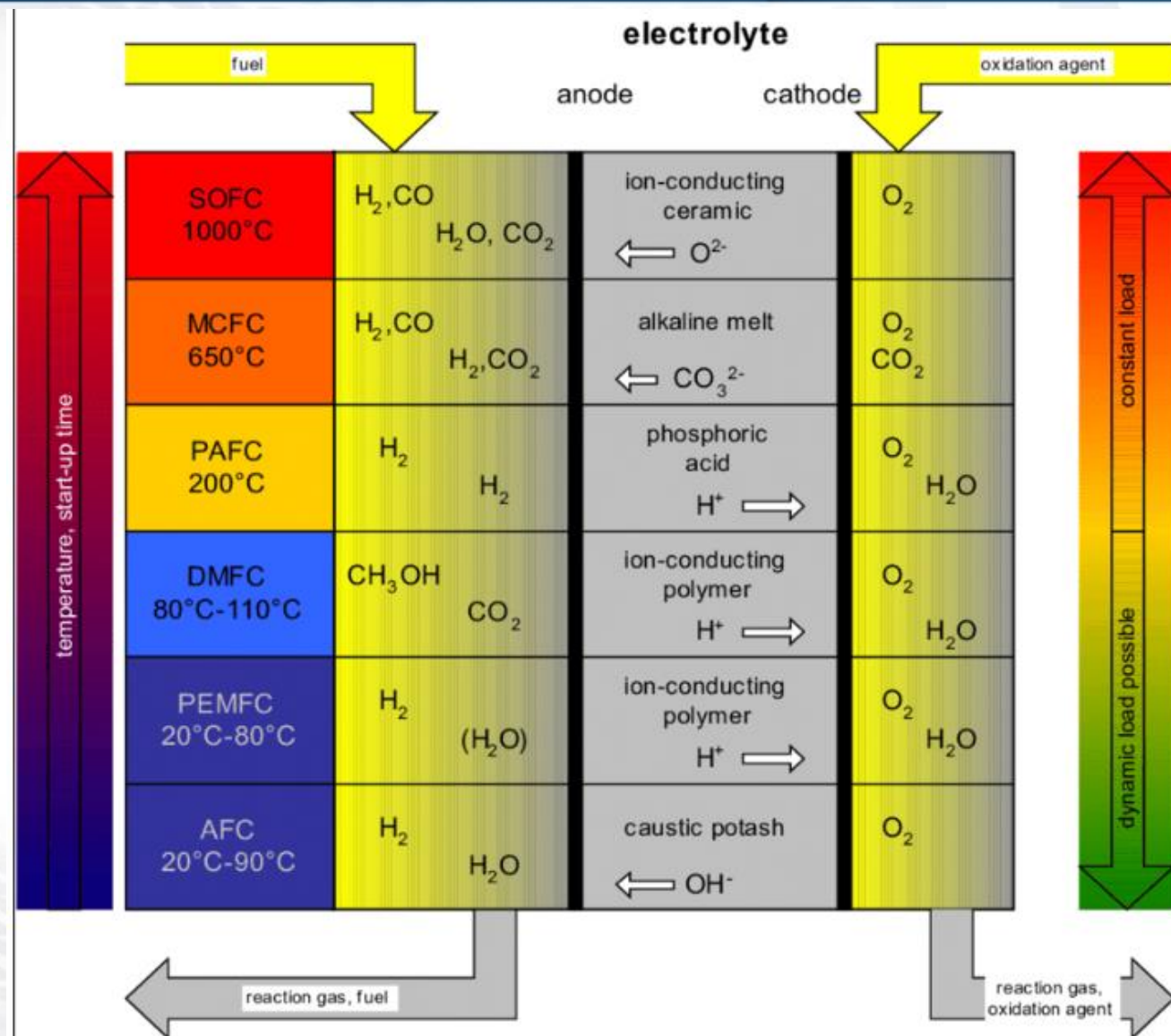


CLASSIFICAÇÃO DA CÉLULAS A COMBUSTÍVEL

- Tipo de eletrólito
- Temperatura de Operação

Abbreviations Description

SOFC	Solid Oxide Fuel Cell
MCFC	Molten Carbonate Fuel Cell
PAFC	Phosphoric Acid Fuel Cell
DEFC	Direct Ethanol Fuel Cell
DMFC	Direct Methanol Fuel Cell
HT-PEMFC	High Temperature Proton Exchange Fuel Cell
PEMFC	Proton Exchange Fuel Cell
AFC	Alkaline Fuel Cell



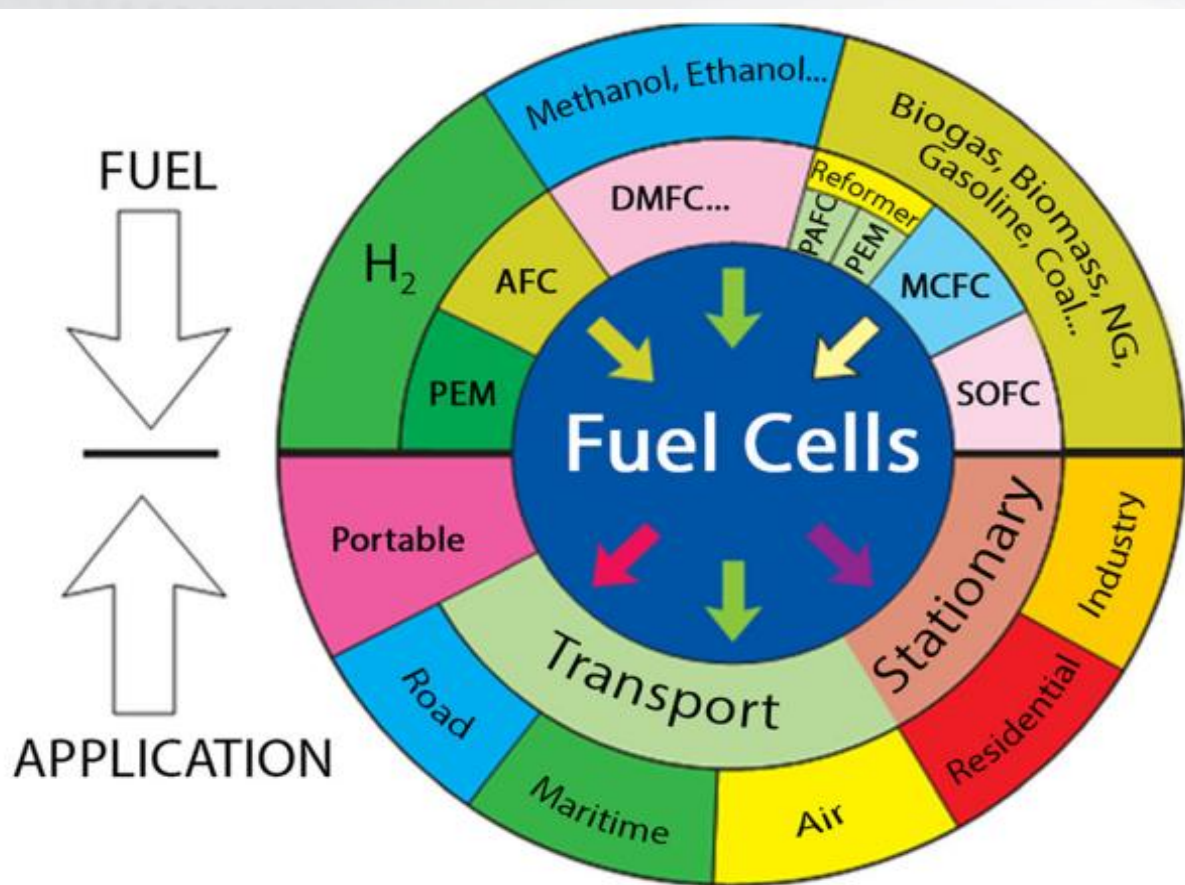


Figure 1: Different types of fuel cells and their application area. Adapted from Commission EC-European (2003).

Yaroslav Kobzar, Rev Chem Eng, 2021 (doi.org/10.1515/revce-2020-0040)

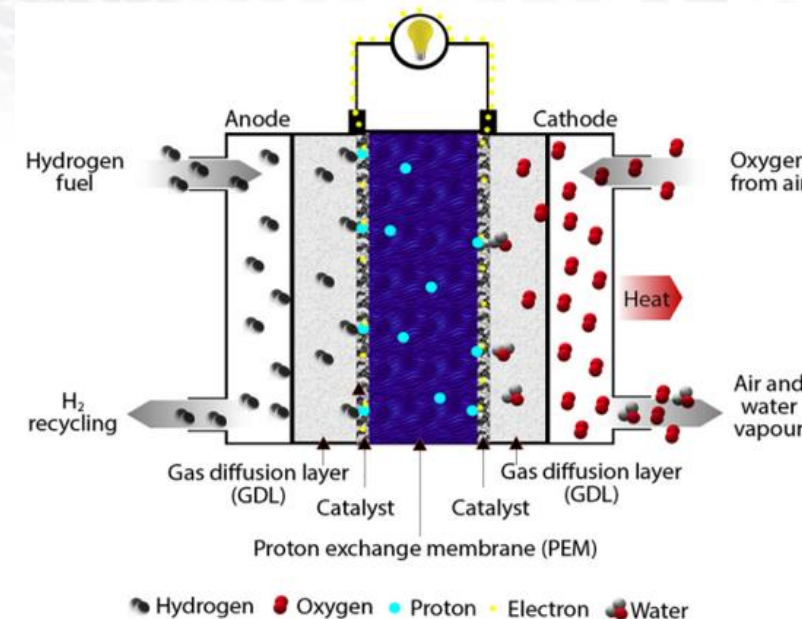
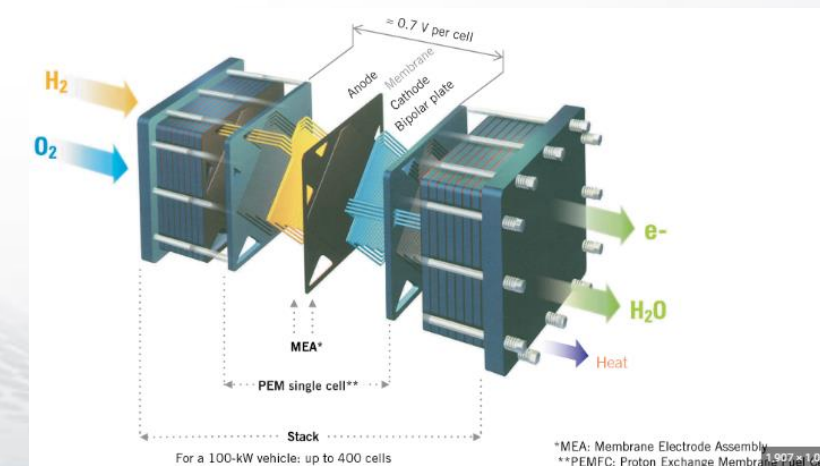
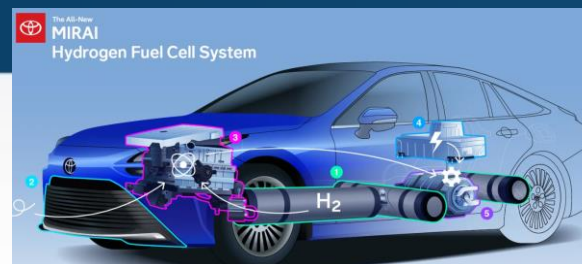


Figure 2: Individual unit of a fuel cell.





Reactor

Fuel Cell

NH₃ Tank

BOP

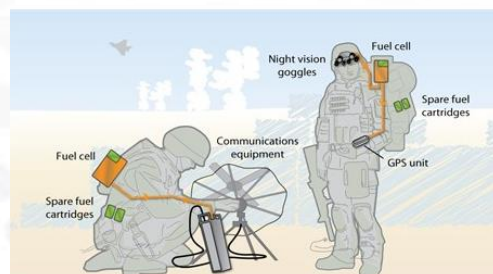
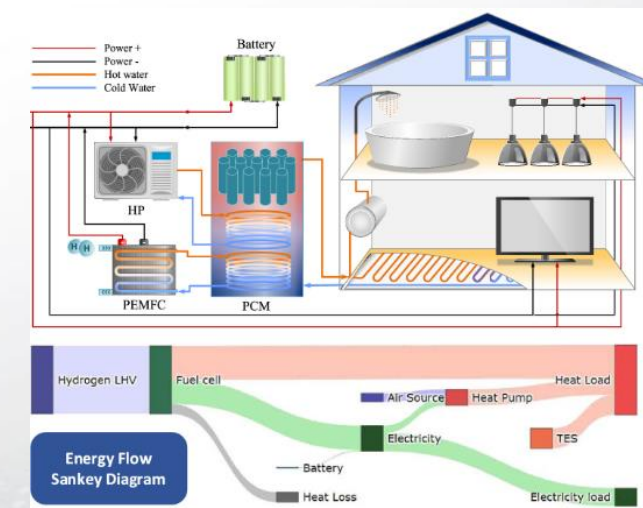


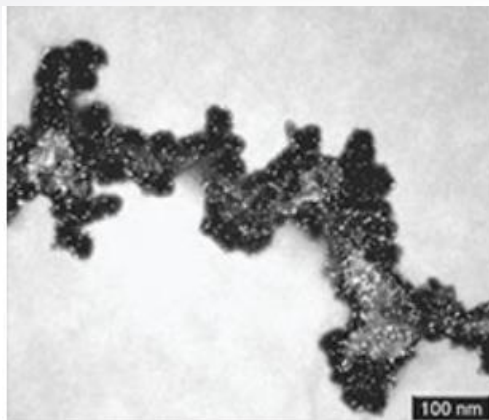
FC hybrid

NH₃ Tank

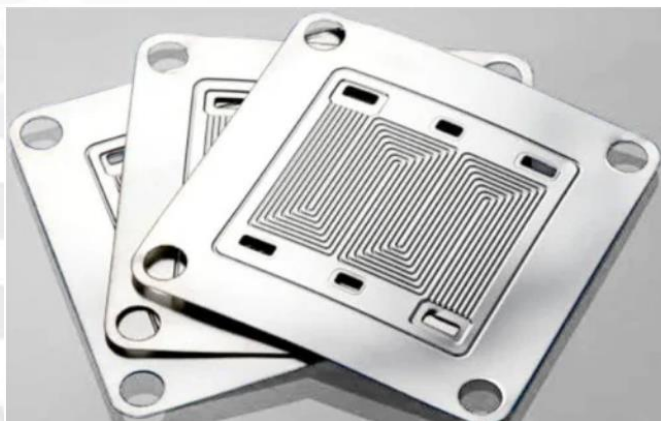
BOP

Reactor

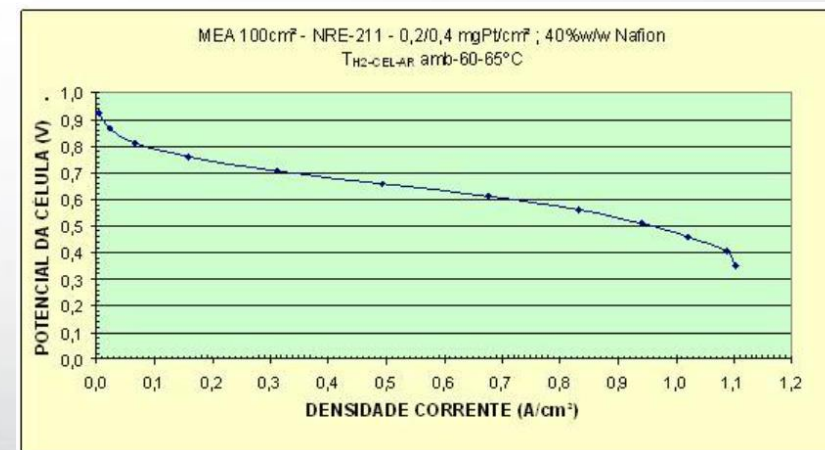




Pt on Carbon – Catalyst Synthesis
Nano Photography through High Resolution SEM



Graphite and Composite Graphite Bipolar Plates



TRANSFORMING
KNOWLEDGE
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PELO FUTURO DO TRABALHO



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