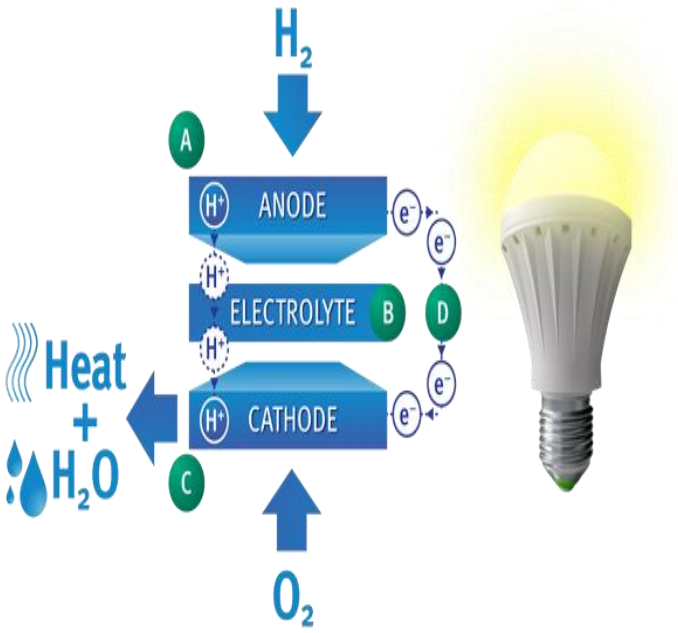
Fuel Cell

- Device that converts Chemical Energy from Fuel into Electrical Energy.
- Fuel cells are different than battery in that they require constant source of Fuel and oxygen to run

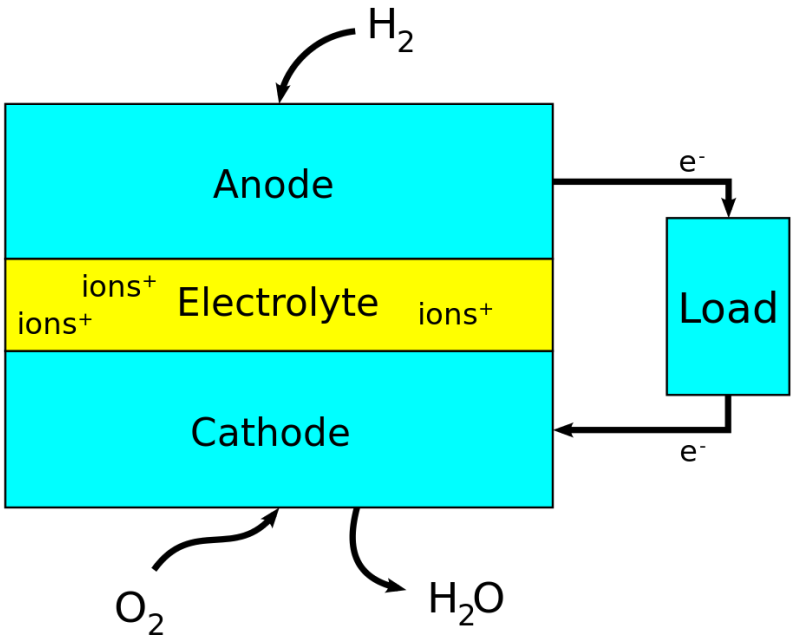
https://www.youtube.com/watch?v=8rofx6Gaz40



Basic components of Fuel Cell

Anode

- act as centre of Oxidation reaction
- To split hydrogen into H^+ions in presence of catalyst



Cathode

- act as Centre of Reduction reaction
- To convert ions into chemicals

$E_{cell} = E^0$ Cathode $- E^0$ Anode

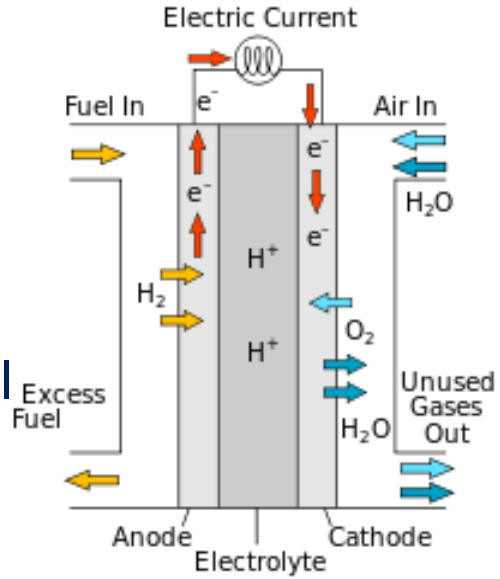
Basic Components of Fuel Cell

Electrolyte

- Use to transport particular ions
- Resistant to electron flow
- Chemical Reaction takes place at Triple Phase Boundary (Electrolyte Electrode and Gasesous Fuel)

H_2– O_2 Fuel cell

- The fuel (direct H_2) undergoes oxidation at anode and releases electrons.
- electrons flow through the external circuit to the cathode.
- At cathode oxidant (O_2 from air) gets reduced.
- The electrons produce electricity while passing through the external circuit
- Electricity is generated continuously as long as fuel and the oxidant are continuously and separately supplied to the electrodes of the cell



cell reaction

- **Anode :** $2\ H_2 \longrightarrow 4\ H^+ + 4\ e^-$
- **Cathode:** $O_2 + 4\ H^+ + 4\ e^- \longrightarrow 2\ H_2O$
- **Net reaction:** $2\ H_2 + O_2 \longrightarrow 2\ H_2O$

Type of Fuel Cell

Low Temperature Fuel Cell

- PEMFC
- AFC
- PAFC

High temperature Fuel cell

- SOFC
- MCFC

Types Of Fuel Cell

Fuel cells are classified on the basis of type of Electrolyte used

- **Alkaline fuel Cell (AFC)**
- **Molten carbonate fuel cell (MCFC)**
- **Phosphoric Acid fuel Cell (PAFC)**
- **Solid oxide fuel cell (SOFC)**
- **Polymer electrolyte membrane fuel Cell (PEMFC)**

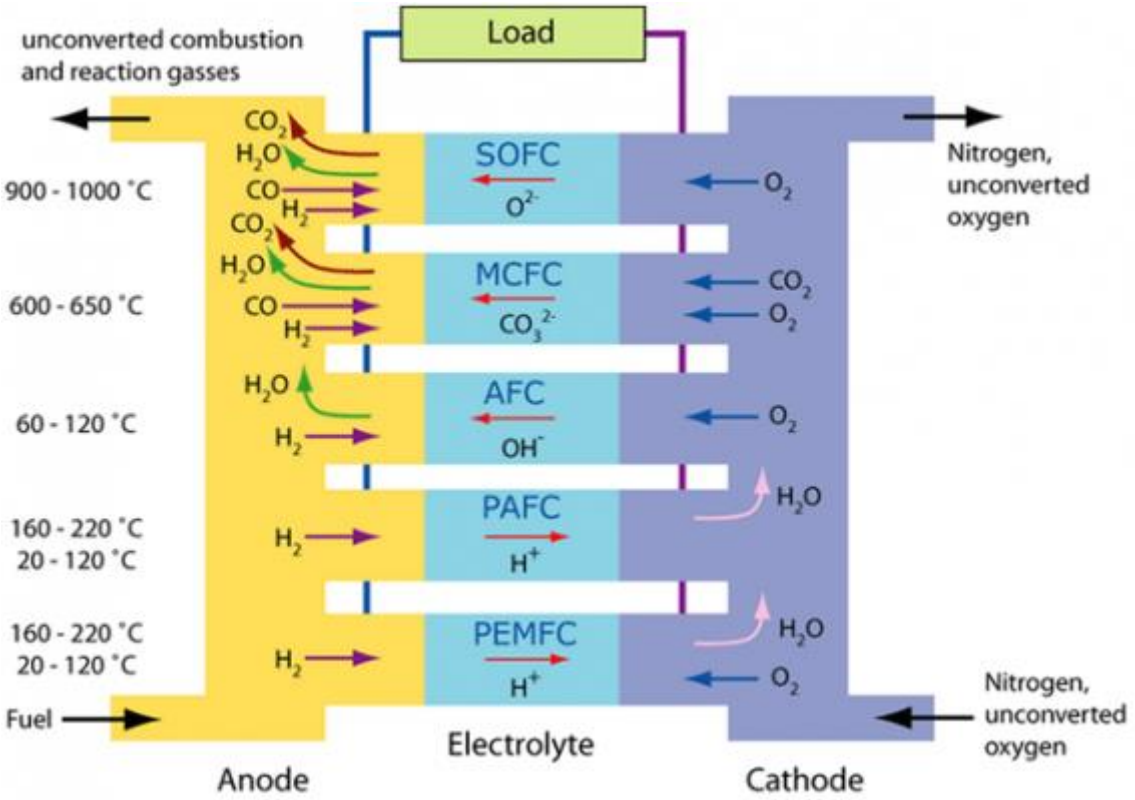
Advantages Of Fuel Cell

- Combine heat and Power enhances efficiency
- high energy density
- Efficient energy conversion
- modular construction
- nonpolluting
- silent
- Safe
- low maintenance
- No release of SOx & NOx Species
- Harmless byproduct (water)

Limitations Of Fuel Cell

- low durability
- complex to operate
- best as primary energy source
- impurities in gas stream shorten life
- pulse demands shorten cell life
- expensive
- limited availability
- low power density per volume

Types Of Fuel Cell



Stacks of fuel Cell

- Fuel Cells are stacked as Single cell produces Electric potential 0.7 V only
- Fuel cells are stacked in sereis to produce more potential so as to meet an applications requirement

Fuel Cell Applications