



ENGINEERING CHEMISTRY

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Energy storage devices – Fuel cells



Class content:

- *$H_2 - O_2$ alkaline fuel cell*
 - *Principle*
 - *Construction and working*
 - *Advantages*
 - *Disadvantages*

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Alkaline fuel cells

- Aqueous solution of **KOH** is used as electrolyte
- **Low temperature** fuel cell (operates at 100°C)
- Oxygen reduction is **more rapid** in alkaline electrolytes than in acid electrolytes
- Use of **non noble metal electro-catalyst** is feasible
- **Carbon containing fuels cannot be used** as CO₂ is formed as product which reacts with the electrolyte, KOH, to form K₂CO₃ which reduces efficiency of the cell



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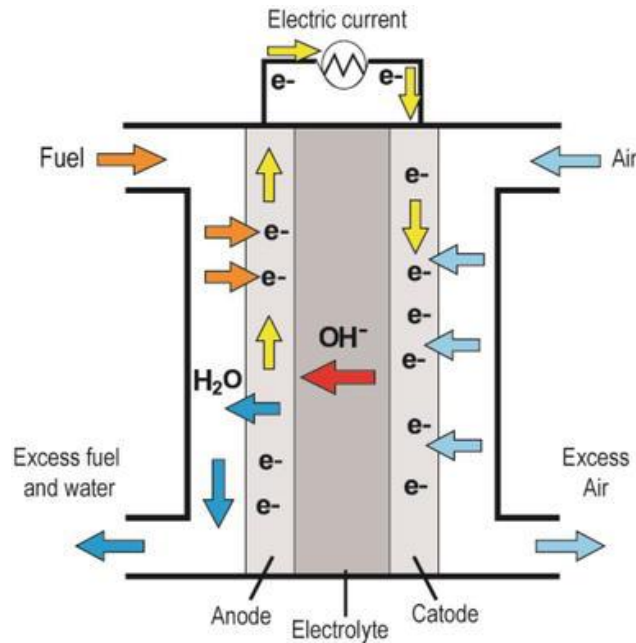
Construction :

- **Anode** : Porous carbon with Pt catalyst
- **Cathode** : Porous carbon with Ag catalyst
- **Fuel** : Hydrogen gas
- **Oxidant** : Oxygen gas
- **Electrolyte** : 30-45 % KOH(warm)

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Cell representation:

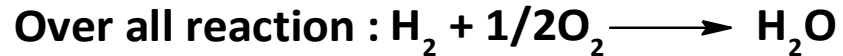
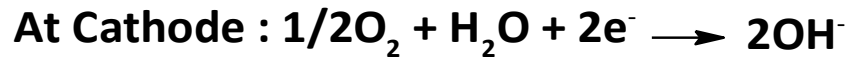
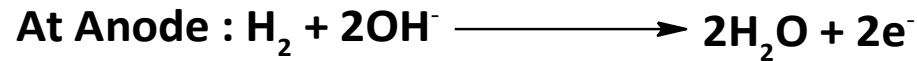


Source: <https://www.intechopen.com/books/new-trends-in-ion-exchange-studies/hydroxide-transport-in-anion-exchange-membranes-for-alkaline-fuel-cells>

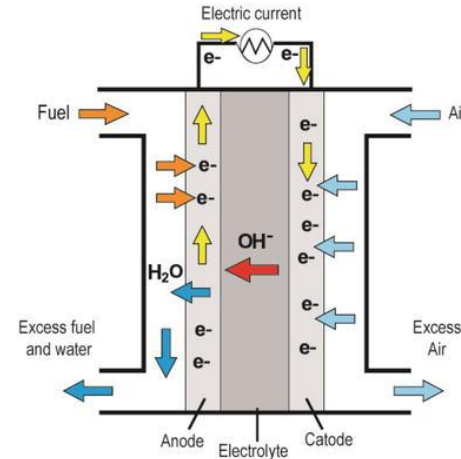
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Working:



- H_2 gas diffuses through anode ,gets adsorbed on the electrode surface ,reacts with OH^- to form water
- At cathode O_2 diffuses through electrode, is adsorbed and reduced to OH^-
- Product is water which dilutes the KOH
- Cell operates at 100°C , so that water from KOH escapes as steam
- The water was used by astronauts for drinking on Apollo spacecraft



Emf = 1.23 V

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Advantages:

- Operates at low temperature
- Alkali is used as electrolyte hence non noble metal catalyst can be used so less expensive

Disadvantages:

- Reactants must be free from C, because on oxidation CO_2 is formed. The alkali reacts with CO_2 to form carbonates which reduce efficiency of the cells; pure fuel and oxidant which are free of carbon compounds must be used
- Liquid electrolytes pose handling problems



THANK YOU
