ENGINEERING CHEMISTRY

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Energy storage devices - Batteries

Class content:

- ***Modern batteries***
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    - ***Construction***
    - ***Working***
    - ***Advantages***
    - ***Disadvantages***
    - ***Applications***

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Modern batteries

Zinc air batteries

- Metal-air battery
- Anode : **Zn** ; Cathode : **O_2**
- Alkaline battery ; electrolyte : **alkali**
- Uses oxygen directly from the atmosphere to produce electrochemical energy
- Cathode active material need not be stored inside the battery
- **Energy density** is very high

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Construction:

Anode : Zinc granules with gelling agent (to immobilize the composite and ensure adequate contact with Zinc granules) and a small amount of electrolyte

Cathode: Carbon (graphite) blended with MnO_2(catalyst) with a wet proofing agent coated on nickel wire mesh support and an outer layer of air permeable Teflon layer. Air access holes on the cathode provide pathway for O_2 to enter the battery

Electrolyte : 30% KOH

Separator : Polypropylene membrane soaked in electrolyte

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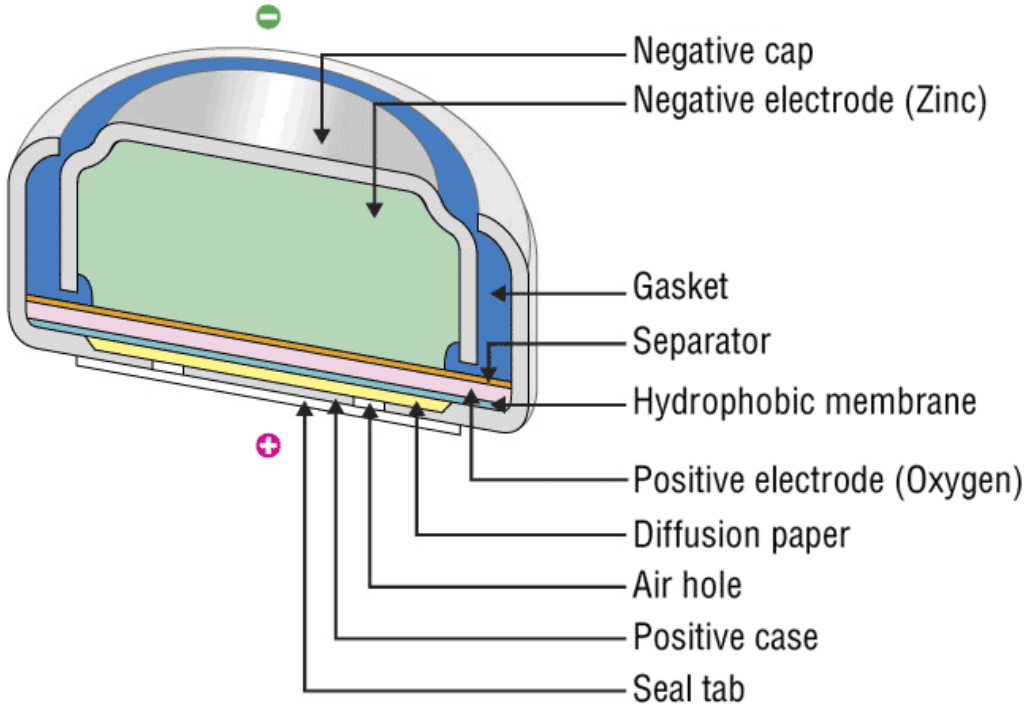
Cross-section of Zn-air battery



Source:http://www.baj.or.jp/e/knowledge/structure.html

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Working:

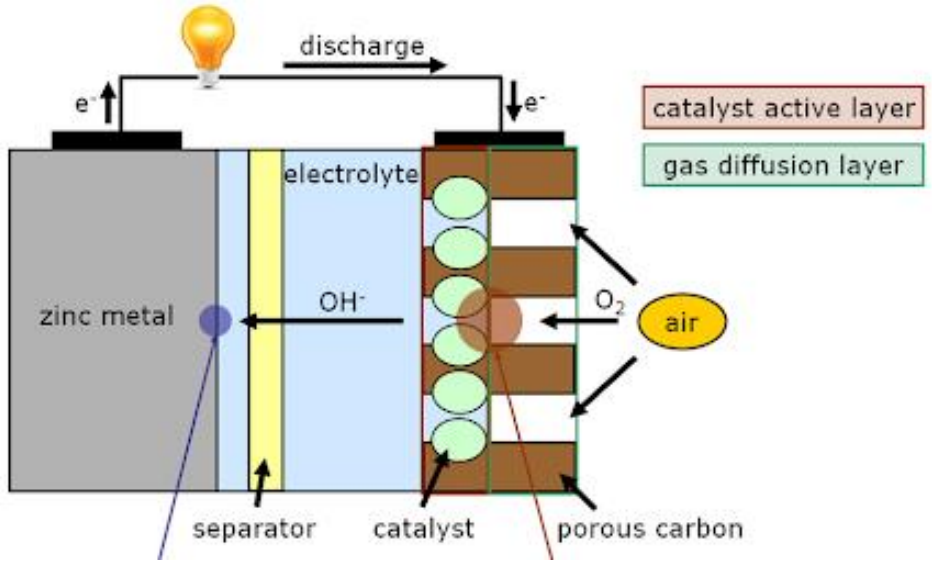
Anode : $Zn \longrightarrow Zn^{2+} + 2e^-$

$Zn^{2+} + 2OH^- \longrightarrow ZnO + H_2O$

$Zn + 2OH^- \longrightarrow ZnO + H_2O + 2e^-$

Cathode : $1/2O_2 + H_2O + 2e^- \longrightarrow 2OH^-$

Overall reaction : $Zn + 1/2O_2 \longrightarrow ZnO$



Source:http://www.kosekgroup.cz/equipment/zinc-air-battery/

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Advantages :

- High energy density : Air is taken directly from atmosphere and need not be stored ; doesn't contribute to the mass of the battery
- Very long shelf life : It can be kept sealed
- Can be miniaturized
- No ecological problems
- Low cost

Disadvantages :

- Limited power output
- Along with air, CO_2 may enter the battery. It reacts with KOH to from K_2CO_3 , which will reduce the efficiency

$$CO_2 + 2KOH \rightarrow K_2CO_3 + H_2O$$

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Applications :

- As power source in hearing aids
- In various medical devices
- In voice transmitters
- Large zinc-air batteries are used in rail-road signaling

THANK YOU

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