SNS COLLEGE OF TECHNOLOGY

Vazhiamyampalayam,Coimbatore-35

(An Autonomous institution)

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DEPARTMENT OF CHEMISTRY

COURSE NAME : 23CHT101- ENGINEERING CHEMISTRY

I YEAR / I SEMESTER

UNIT : 2. ELECTROCHEMICAL POWER SOURCES

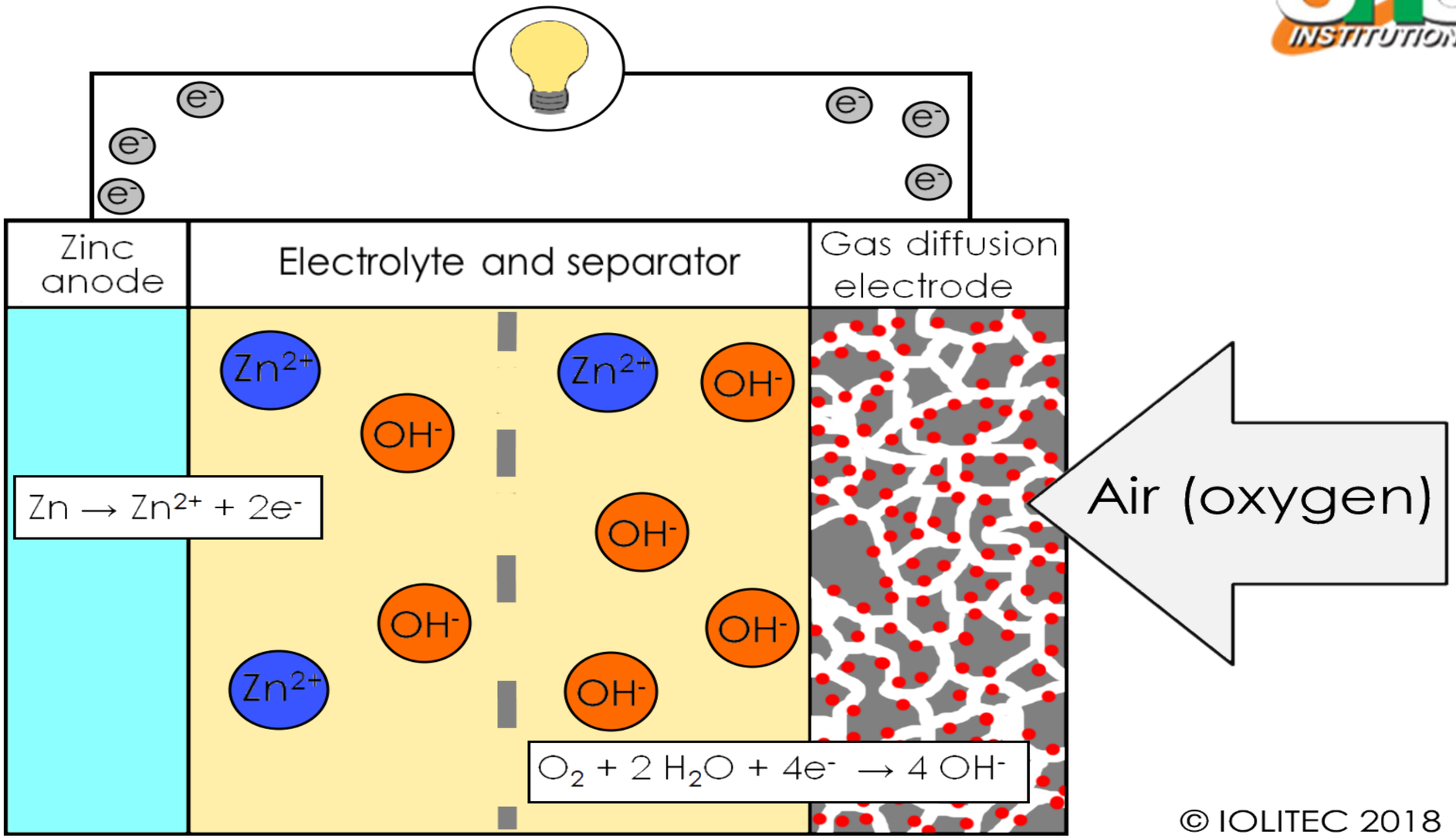
TOPIC : 4.Zinc –Air battery

Zinc – Air Battery

- Zinc – air batteries are more popular. They were commercialized in 1977.
- Zinc air batteries are the batteries which breathe air, that is , they use oxygen directly from the air to bring about the electrochemical reaction.
- These are basically alkaline batteries in which the cathodic active material is not stored in the cell.

CONTRUCTION

- Anode is composed of granulated zinc powder mixed with an aqueous solution 30% KOH and a gelling agent to immobilize the material.
- Cathode is composed of mixture of carbon and the catalyst and a gelling agent held on a nickel coated steel matrix.
- Several hydrophobic, gas permeable, thin layers of Teflon are provided to steady the air entry.
- Electrolyte contains 30% KOH.
- There is also vent for the entry of air or O_2 into the cell.
- The container is made of glass and has a separator made of nylon.


e⁻
e⁻
e⁻
e⁻
e⁻
e⁻
Zinc anode
Electrolyte and separator
Gas diffusion electrode
Zn²⁺
Zn²⁺
OH⁻
OH⁻
OH⁻
OH⁻
OH⁻
Zn²⁺
OH⁻
Zn → Zn²⁺ + 2e⁻
O₂ + 2 H₂O + 4e⁻ → 4 OH⁻
Air (oxygen)
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The reactions involved in the cell are:

At the anode:

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

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

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

At the cathode:

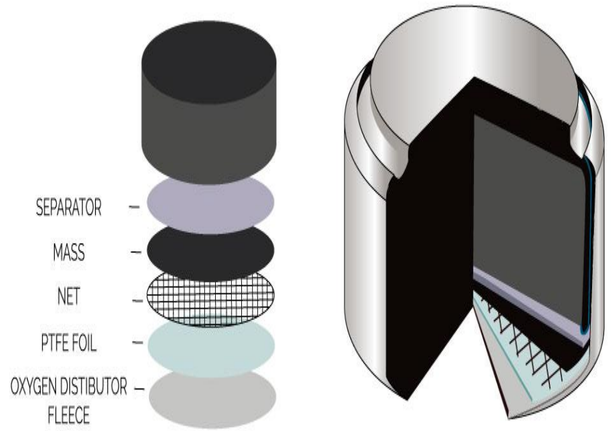
$$H_2O + {}^1/_2\, O_2 + 2e^- \longrightarrow 2OH^-$$

The over all cell reaction :

$$Zn + {}^1/_2\, O_2 \longrightarrow ZnO$$

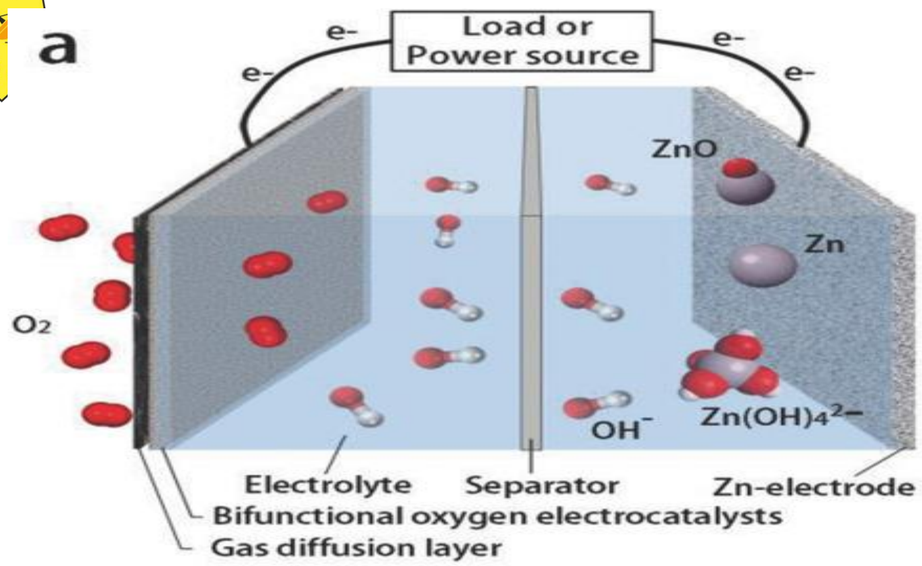
The battery offers an EMF of 1.25-1.35V.

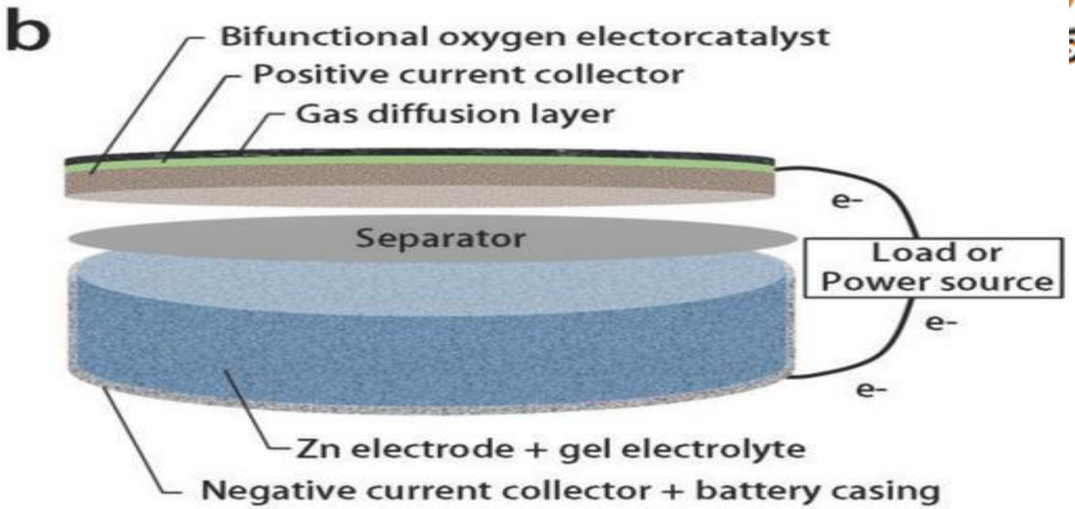
- These are light and have high energy density.
- These are relatively eco-friendly and have unlimited capacity.
- These suffer from low shelf life. still, they are known for low energy cost.

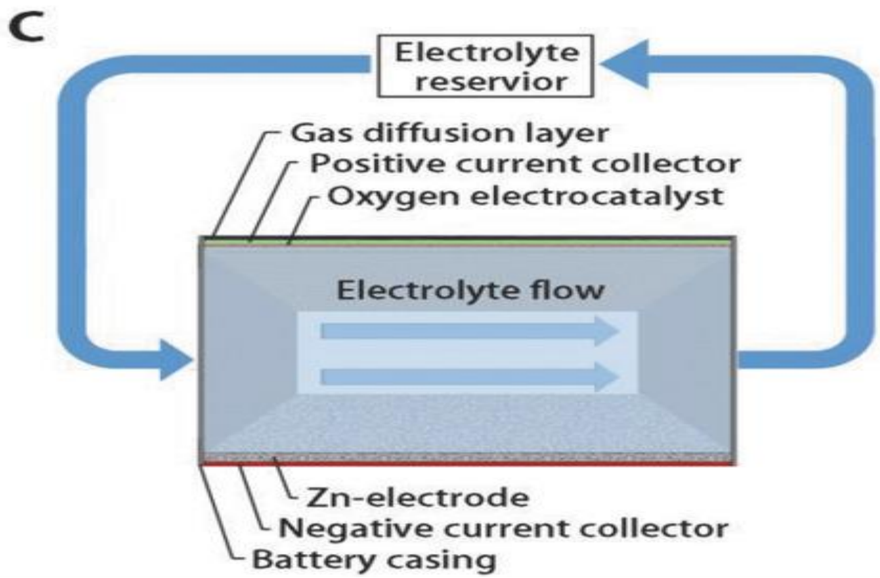


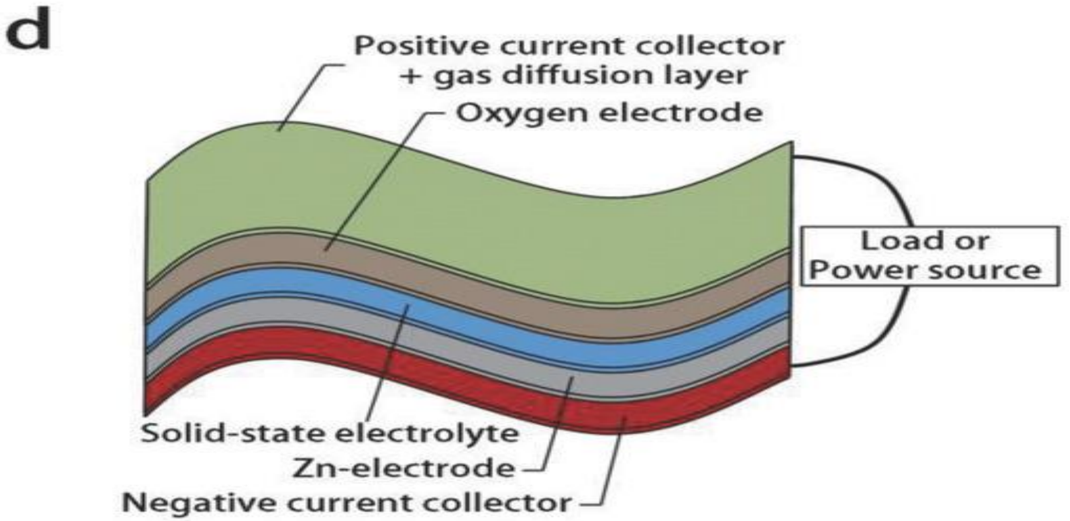
SINO VOLTAICS

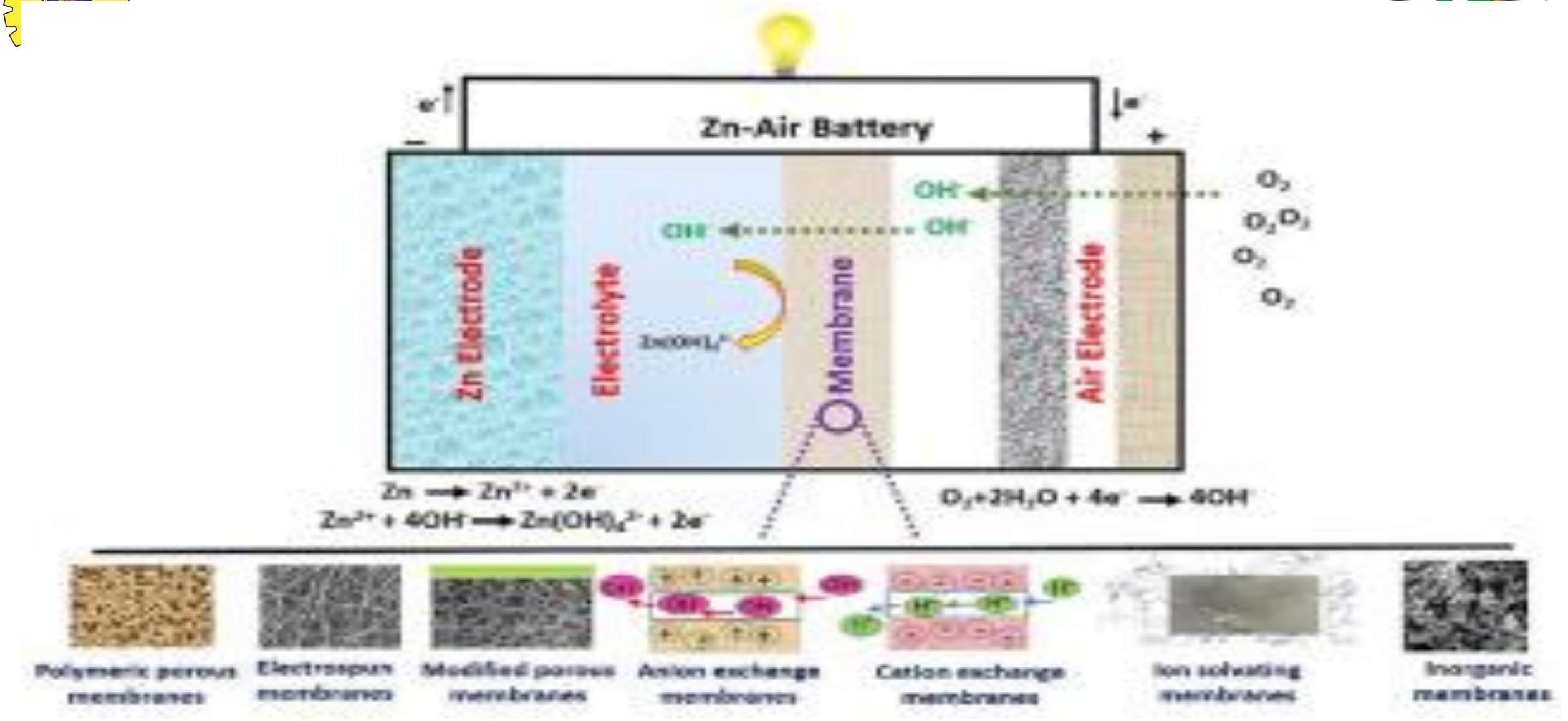
Zinc-Air Battery


a
e-
Load or
Power source
e-
e-
e-
ZnO
Zn
O2
OH-
Zn(OH)4 2-
Electrolyte
Separator
Zn-electrode
Bifunctional oxygen electrocatalysts
Gas diffusion layer


b
Bifunctional oxygen electorcatalyst
Positive current collector
Gas diffusion layer
Separator
e-
Load or
Power source
e-
e-
Zn electrode + gel electrolyte
Negative current collector + battery casing


c
Electrolyte
reservior
Gas diffusion layer
Positive current collector
Oxygen electrocatalyst
Electrolyte flow
Zn-electrode
Negative current collector
Battery casing


d
Positive current collector
+ gas diffusion layer
Oxygen electrode
Load or
Power source
Solid-state electrolyte
Zn-electrode
Negative current collector


Zn-Air Battery
e⁻
e⁻
Zn Electrode
Electrolyte
Membrane
Air Electrode
OH⁻
OH⁻
O₂
Zn → Zn²⁺ + 2e⁻
Zn²⁺ + 4OH⁻ → Zn(OH)₄²⁻ + 2e⁻
O₂+2H₂O + 4e⁻ → 4OH⁻
Polymeric porous membranes
Electrospun membranes
Modified porous membranes
Anion exchange membranes
Cation exchange membranes
Ion solvating membranes
Inorganic membranes

REFERENCES

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2. Wiley, “Engineering Chemistry”, John Wiley & Sons. InC, USA.
3. P.C.Jain & Monicka Jain, “Engineering Chemistry” , Dhanapat Rai Publising Company Pvt. Ltd. 2017.

THANK YOU