ENGINEERING CHEMISTRY

Department of Science and Humanities

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Corrosion Chemistry

Class content:

- ***Corrosion control***
  - ***Cathodic protection***
    - ***Sacrificial anode method***

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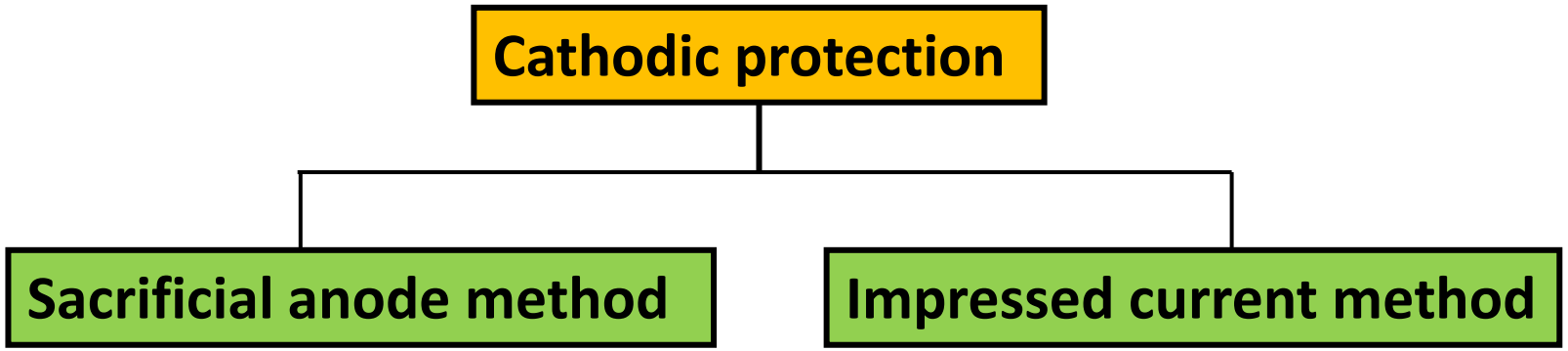
Cathodic protection:

- By converting it **completely into cathode** and no part of it is allowed to act as anode
- Cathode does not undergo corrosion so the structure is protected



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Sacrificial anode method:

- In this method, protected metal structure is converted into a cathode **by connecting it to a more active metal**
- This active metal (example: zinc, magnesium) acts as an **auxiliary anode**
- These metals being more active, acts as anode and undergo **preferential corrosion**, protecting the metal structure
- Since the **anodic metals are sacrificed** to protect the metal structure, the method is known as sacrificial anode method
- Exhausted anodes have to be **replaced periodically**

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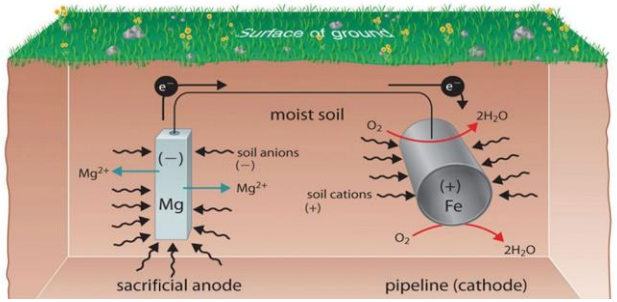
Examples:

- **Mg/Zn bars** are fixed to the **sides of ocean going ships** to act as sacrificial anodes

Source:https://thenavalarch.com/ship-corrosion-cathodic-protection-sacrificial-anodes/

- **Mg/Zn blocks** are connected to **buried pipe lines**



Source:https://www.pipelineprotection.co.uk/services/cathodic-protection/

- A **Mg block** connected to a **buried oil storage tank**

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Advantages:

- The method is simple
- Low installation cost
- Does not require power supply

Disadvantages:

- Involves recurring expenditure for replacement of consumed anodes

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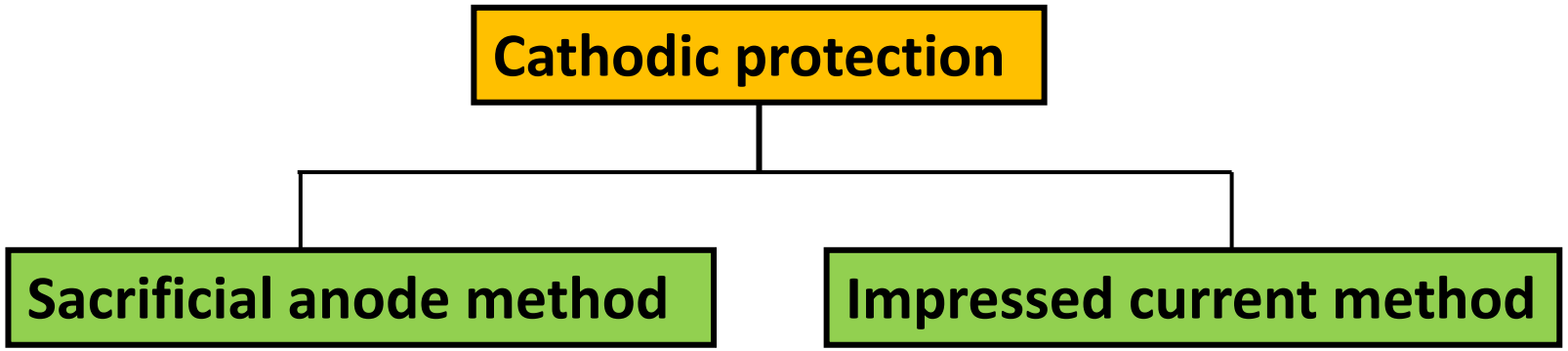

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Impressed current method:

- By applying a **direct current**

- The **protected metal is made cathodic** by connecting it to the cathode of the external source of current

Anode of the external source is usually connected to an **inert electrode** like graphite; Platinum, silicon, iron are also used as anodes

- A **backfill of coke ,bentonite** is used to improve efficiency of the anode

(The prime purpose of using the backfill is to reduce electrical resistivity. This provides a lower anode-to-earth resistance and greater current outputs in cases where the surrounding soil is of high resistivity).

- The metal structure being cathode **does not undergo corrosion**

- Anode being inert remains **unaffected**

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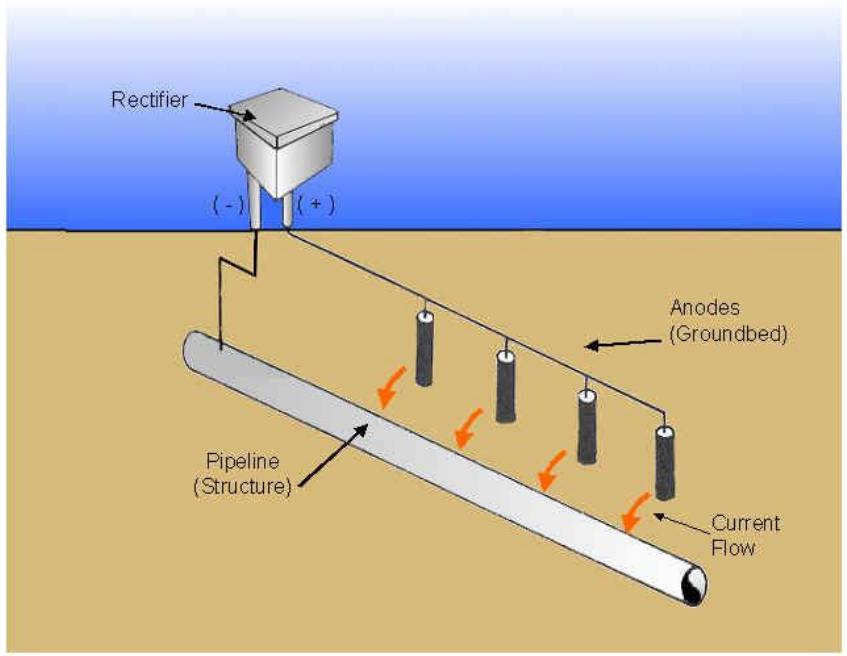
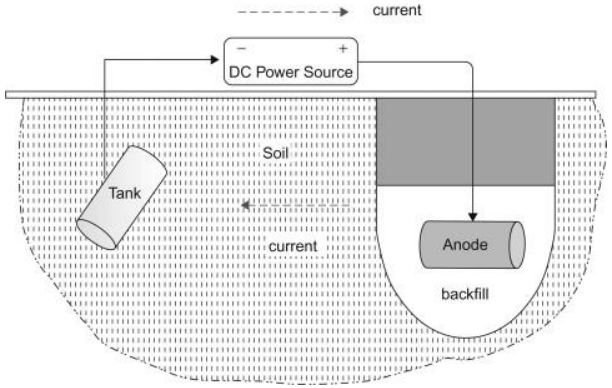


Source:https://www.mcwaneductile.com/blog/v-bio-r-or-cathodic-protection-an-honest-comparison/



Source:https://www.sciencedirect.com/topics/engineering/impressed-current-system

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Advantages:

- One installation can protect large area of metal

Limitations:

- Rather expensive, since it needs **high current** for safe protection of structure

- If the impressed current is **not uniform** on the entire surface of the protected structure, **localized corrosion** takes place on the protected metal

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- If hydrogen liberation is the cathodic reaction on the metal surface, then the protected metal may suffer from **hydrogen embrittlement**

- **Hydrogen embrittlement:**

H_2 molecule being small **enters the metal lattice** and when the pressure increases , it **causes blisters** and makes the metal brittle

THANK YOU

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