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ENGINEERING CHEMISTRY

Department of Science and Humanities

ENGINEERING CHEMISTRY

Corrosion Chemistry



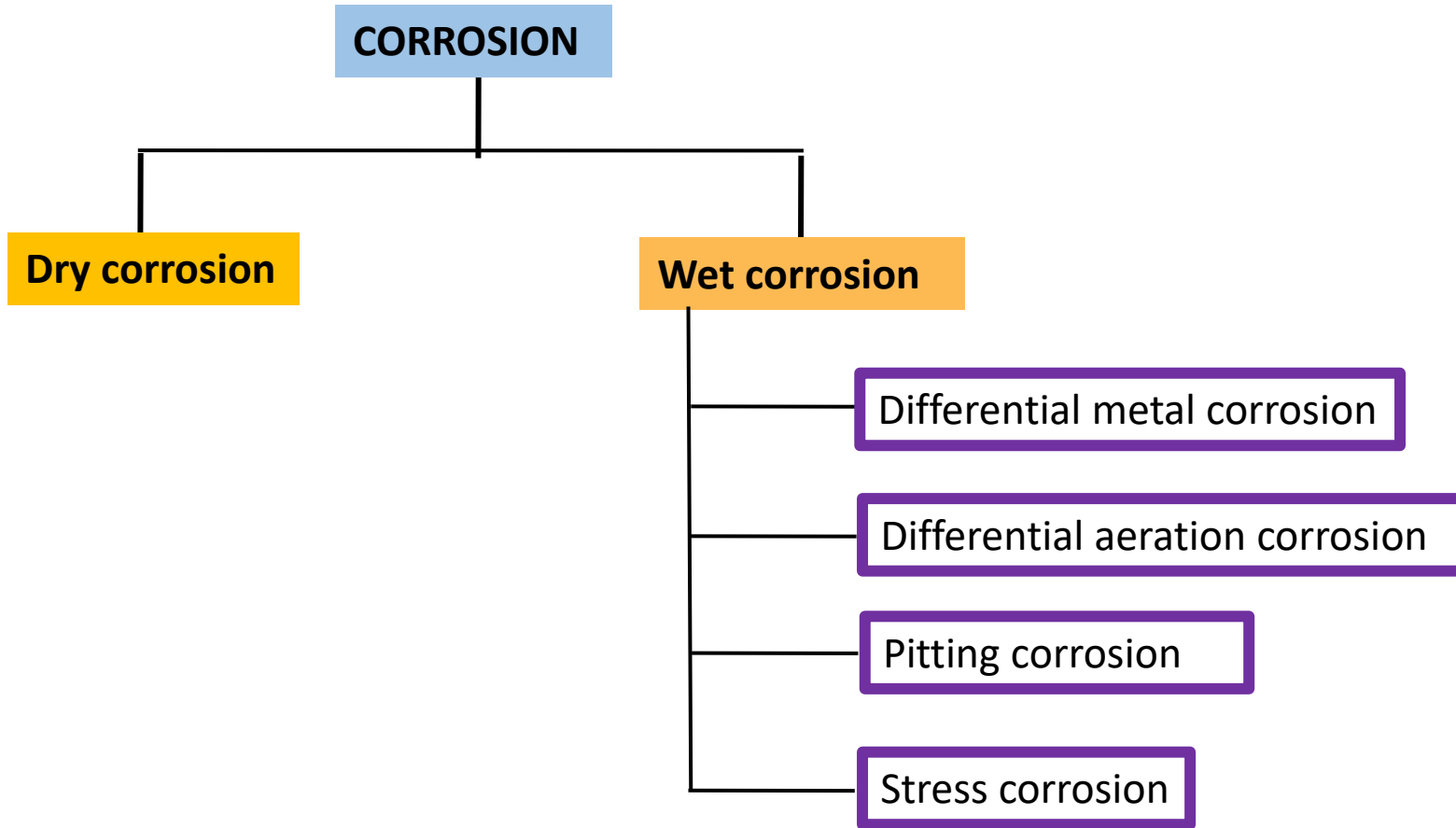
Class content:

- *Types of electrochemical corrosion*
 - *Differential metal corrosion*
 - *Differential aeration corrosion*

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Types of corrosion



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Differential metal corrosion :

- Also called **galvanic corrosion**
- When **two dissimilar metals** are in contact with each other and are exposed to a corrosive environment
- The two metals differ in their **electrode potentials**. The metal with lower electrode potential acts as anode and the other metal with higher electrode potential acts as cathode
- The anodic metal undergoes oxidation and gets corroded. The cathodic metal remains unaffected
- The driving force for corrosion is the **difference in electrode potentials** of the two metals

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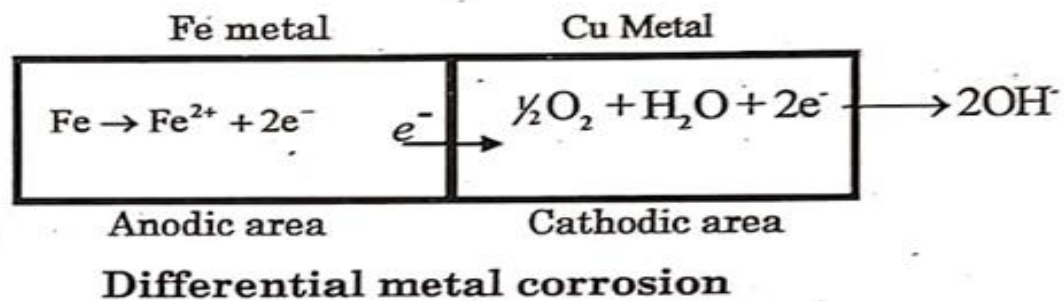
Reactions:

At anode: $M \rightarrow M^{n+} + ne^{-}$

At cathode: $2H_2O + O_2 + 4e^{-} \rightarrow 4OH^{-}$

Examples:

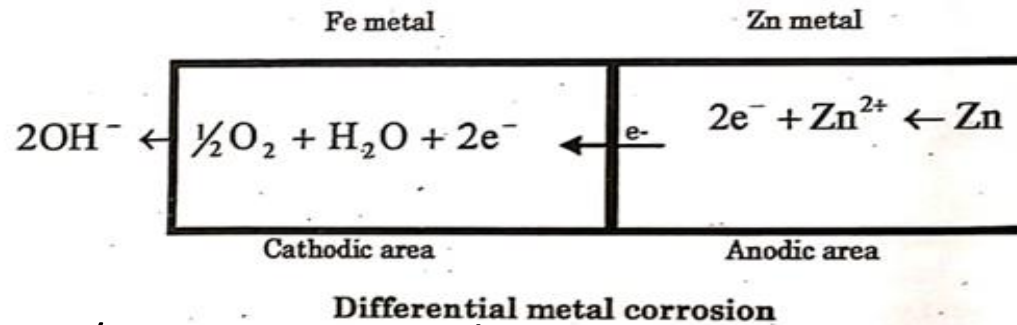
- Iron in contact with copper
- Standard electrode potential of Fe (-0.44 V)
Cu (0.34 V)



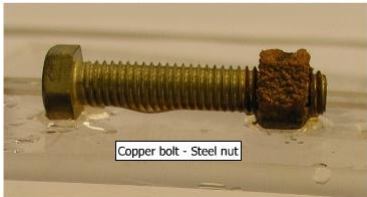
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- Iron in contact with zinc
- Standard electrode potential of Zn (-0.76 V)
Fe (-0.44 V)



- Steel screws/rivets in copper sheet



Source: <https://faculty.kfupm.edu.sa/me/hussaini/corrosion%20engineering/model-03.htm>

- Steel pipe connected to copper plumbing



Source: <https://www.plumbingjohannesburg.co.za/mixing-copper-and-galvanized-pipes-is-a-bad-idea/>

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Differential aeration corrosion:

- When a metal is exposed to **different concentrations of air** (O_2), part of the metal exposed to **lower concentration of O_2 becomes anodic** and undergoes corrosion
- Other part of the metal exposed to **higher concentration of oxygen becomes cathodic** and remains unaffected
- The difference in oxygen concentration produces a potential difference and cause corrosion current to flow

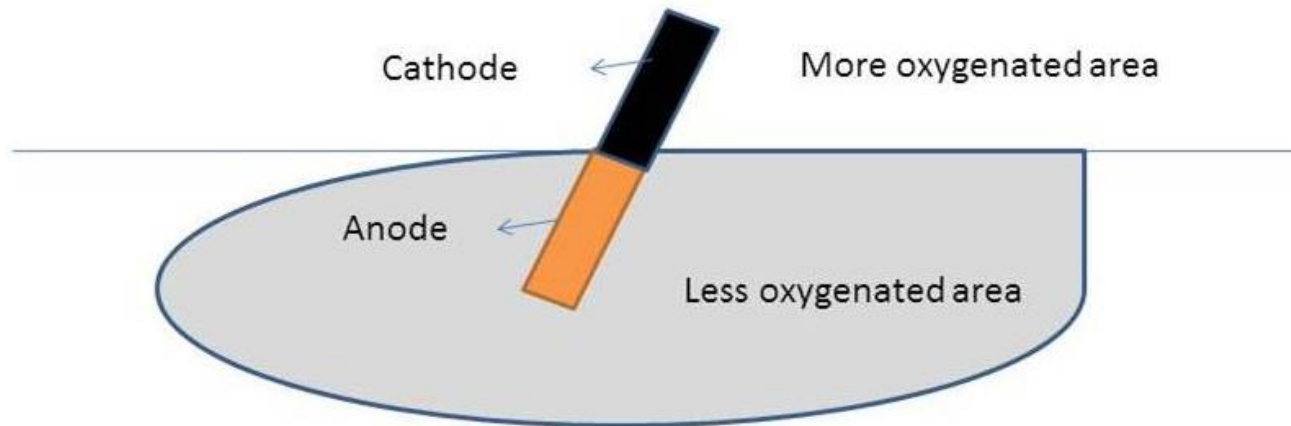
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Reactions:

At anode: $M \rightarrow M^{n+} + ne^{-}$

At cathode: $2H_2O + O_2 + 4e^{-} \rightarrow 4OH^{-}$



Source: <https://chembldeacet.wordpress.com/2018/09/01/differential-aeration-corrosion/>

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Examples:

- Nail from a wall



Source: <https://www.houzz.com/discussions/4120639/nails-rusted-within-the-wall>

- Wire mesh



Source: <https://www.pixtastock.com/photo/46177070>

- Paper pin inside a paper



THANK YOU

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