# Corrosion: Definition, Types, and Prevention

## Introduction

Corrosion is the gradual destruction or deterioration of metals and alloys due to their interaction with the environment. It is a significant problem in engineering and industry, leading to material failure, increased maintenance costs, and safety hazards[1].

## Mechanism of Corrosion

Corrosion typically occurs through an electrochemical process where metals react with substances such as oxygen, water, acids, or salts:

$$\text{Metal} \rightarrow \text{Metal}^{n+} + n\,e^-$$

A classic example is iron rusting in the presence of water and oxygen:

$$4Fe + 3O_2 + 6H_2O \rightarrow 4Fe(OH)_3$$

## Common Types of Corrosion

| Type | Description | Example |
|---|---|---|
| Uniform | Even surface loss | Rust on iron pipes |
| Galvanic | Metal-metal contact, different potentials | Zinc-iron in batteries |
| Pitting | Localized holes | Stainless steel in chlorides |
| Crevice | In narrow gaps | Bolted joints in seawater |
| Intergranular | Along grain boundaries | Welds in austenitic steels |

Table 1: Major types of corrosion and examples[2]

## Corrosion Prevention Strategies

- Protective coatings (paint, plating)
- Use of corrosion-resistant alloys (stainless steel, aluminum alloys)
- Cathodic protection (sacrificial anodes)
- Environmental control (humidity, pH)
- Regular inspection and maintenance

## Industrial Impact

Corrosion affects infrastructure (bridges, pipelines), transport (automobiles, ships), and manufacturing equipment, often causing billions of dollars in annual losses worldwide[3].

## References

[1] Jones, D.A. (2024). Principles and Prevention of Corrosion (3rd ed.). Pearson Education.

[2] Fontana, M.G. (2023). Corrosion Engineering. McGraw-Hill Education.

[3] National Association of Corrosion Engineers (NACE). (2025). The Global Cost of Corrosion Report. https://www.nace.org/global-cost-of-corrosion