

CORROSION OF METAL PACKAGING MATERIALS

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- Metals are important materials for the packaging of foods, combining properties of strength, toughness, ductility and impermeability.
- However, the chemical structure that gives them their valuable practical properties is also responsible for their main weakness their susceptibility to corrosion.
- Corrosion is the term used to describe the chemical reaction between a metal and its environment to form compounds, it is a universal process affecting all metals to some extent.

Corrosion is defined as the reaction of a metallic material with its environment and can result in a functional failure of metallic component or of a complete system.

- Exposure of a surface to air, water and caustic chemicals are responsible for corrosion.
- Since metals are good conductors, they undergo electrochemical changes on their surfaces.
- The compound that is formed during corrosion is referred to as **corrosion product** and the metal is referred to as **corroded**.
- The **corrosion media** are generally liquid (mostly aqueous solution), but also solids and gases.

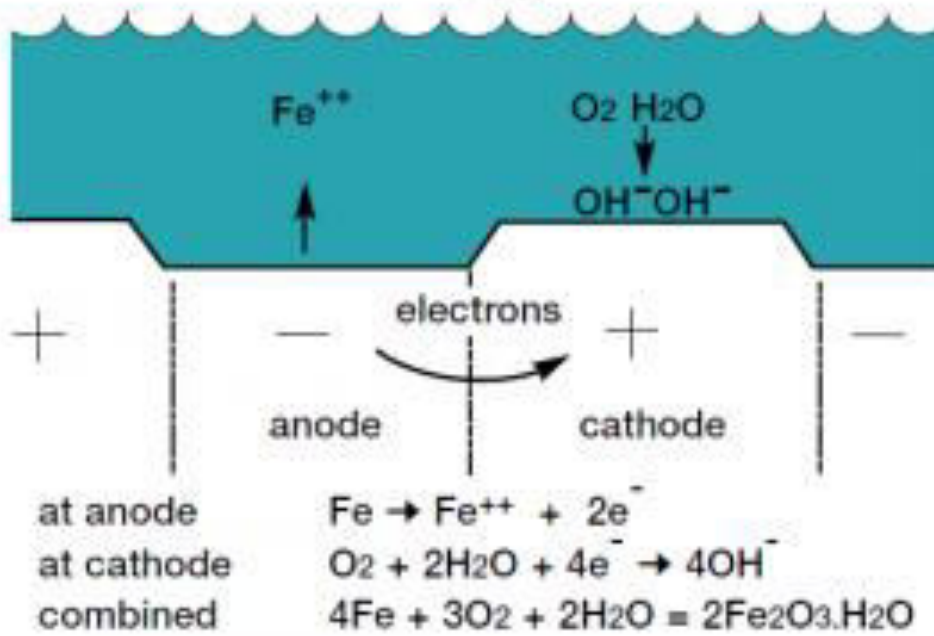
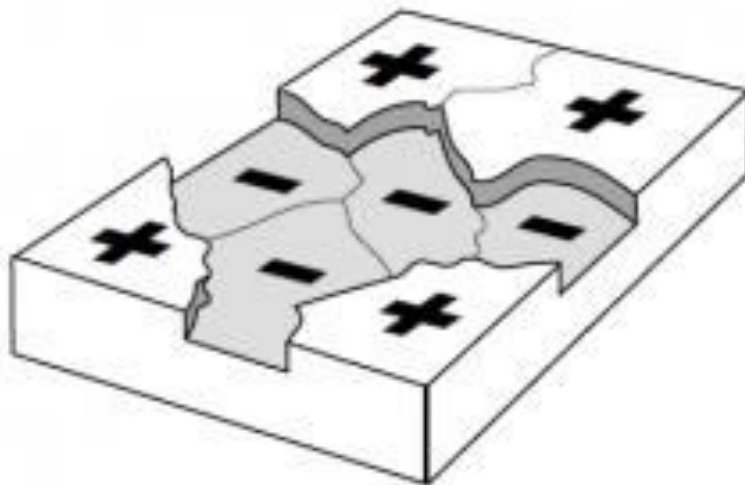
Corrosion can be either dry or wet type:

Dry corrosion: it involves the **direct attack of dry gases** (air and oxygen) on the metals through chemical reactions. As a result an oxide layer is formed over the surface. This type of corrosion is not common.

Wet corrosion: it involves the **direct attack of aqueous media** (strong or dilute, acidic or alkaline) on metal through electrochemical reactions. The moisture and oxygen are also responsible. This type of corrosion is quite common.

THEORIES / MECHANISMS OF CORROSION

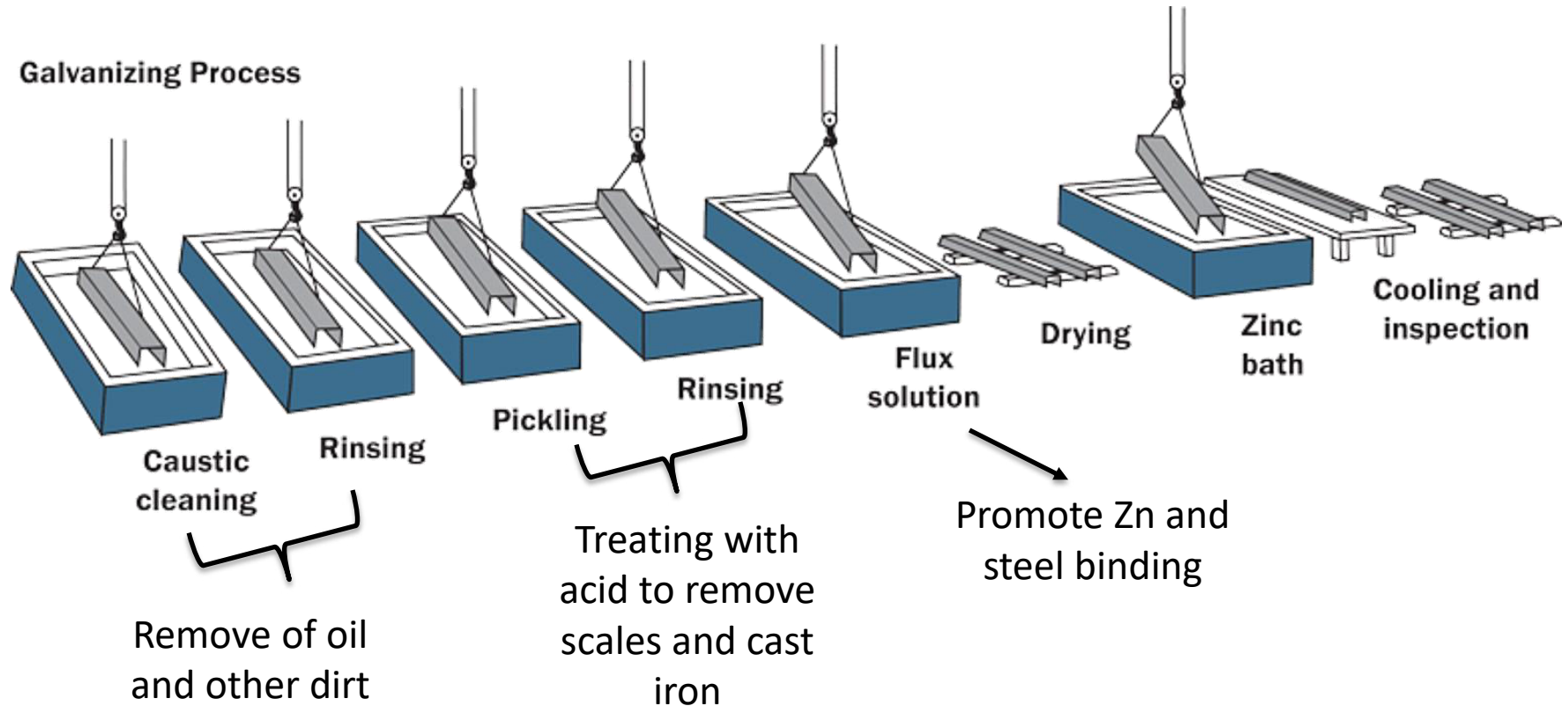
- The metal surface undergoes an electrochemical reaction with moisture in the atmosphere.
- This theory is known as **electrochemical theory** of corrosion.
- The mechanism involves the formation of a galvanic cell (anodic and cathodic areas), by different metals (Fe and Cu) or in different areas on the same piece of metal (for example, iron).



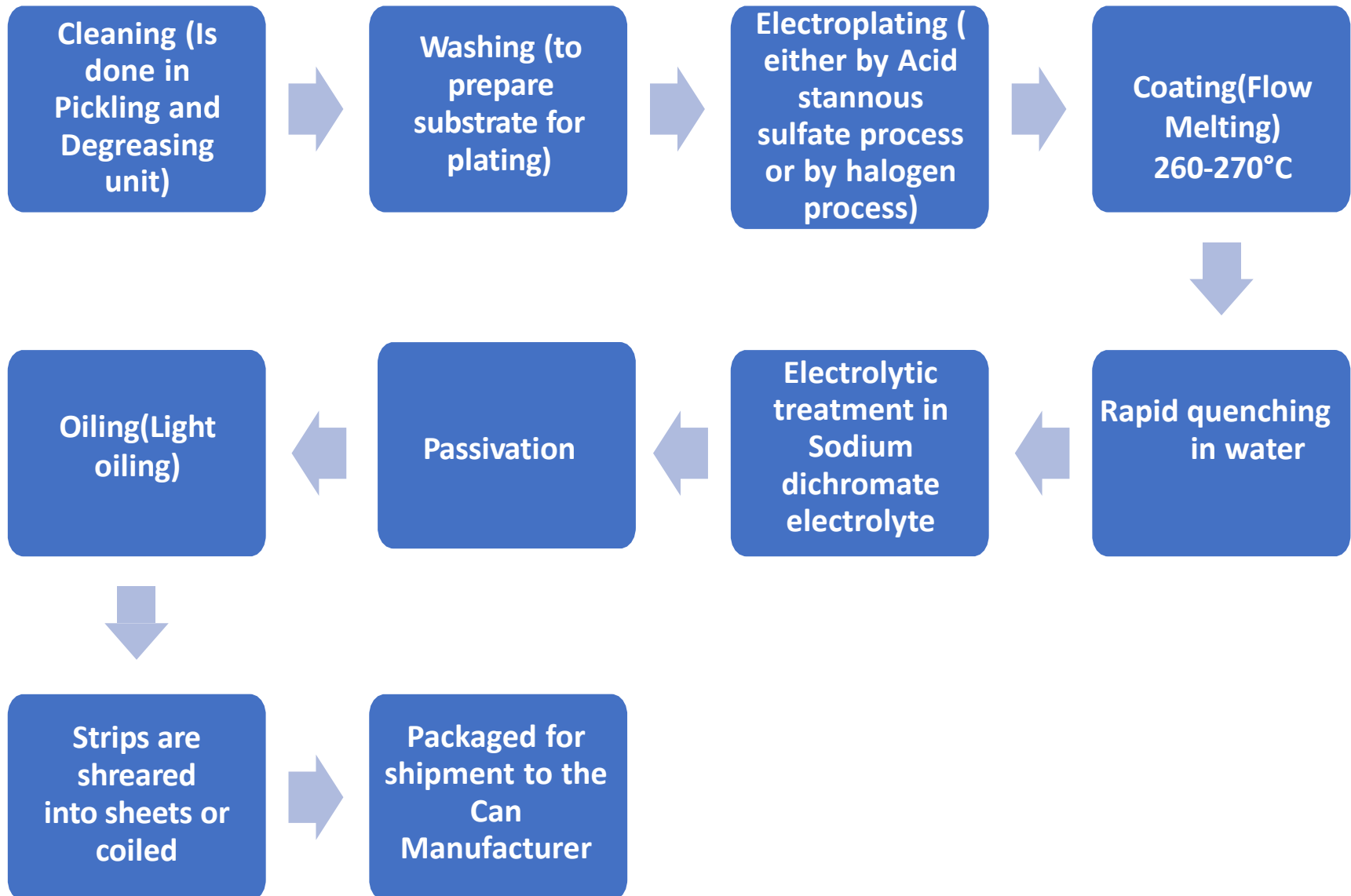
PREVENTION AND CONTROL OF CORROSION

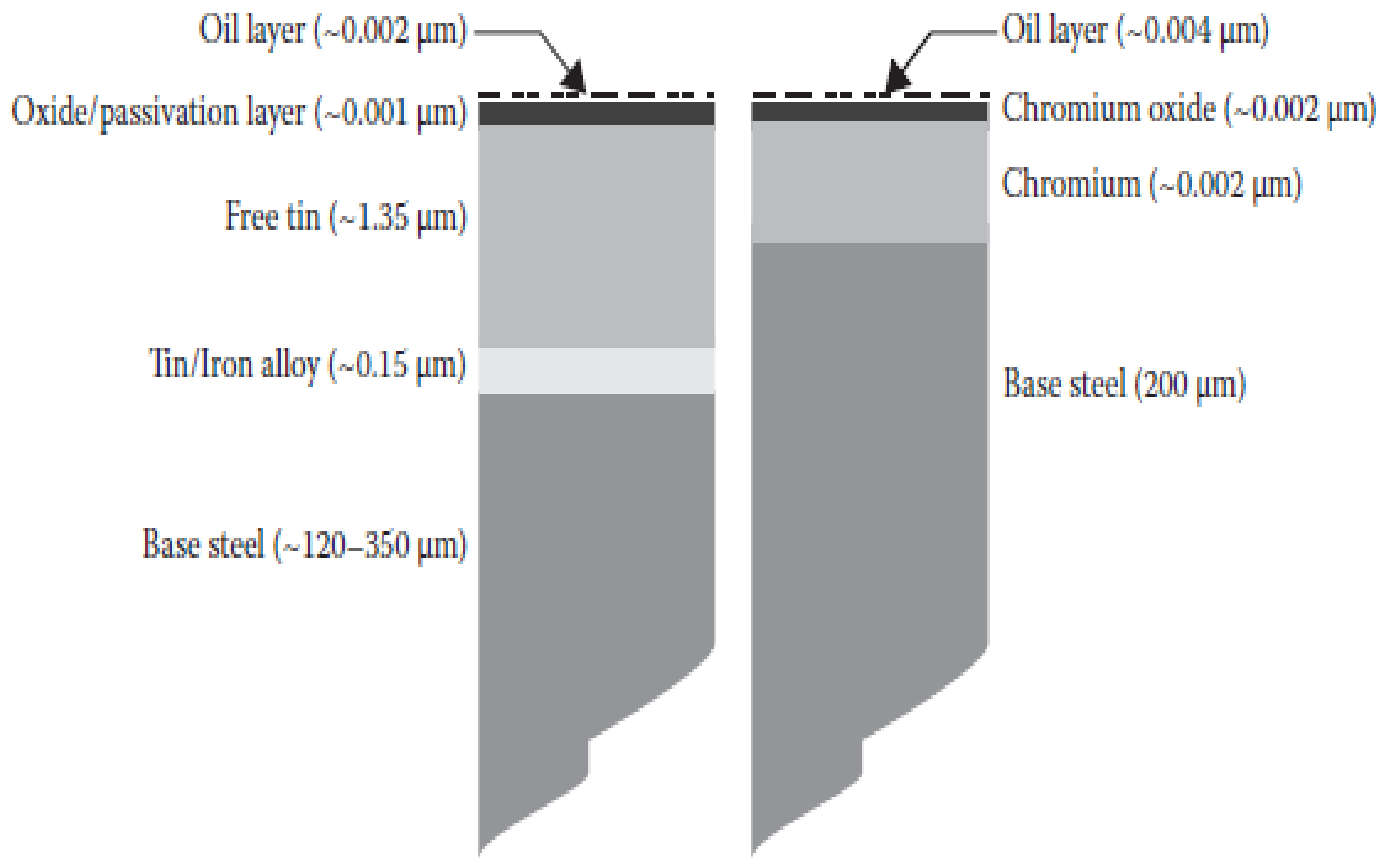
1. Galvanization

Galvanizing is the process of immersing iron or steel in a **bath of molten zinc** to produce a **corrosion resistant**, multi-layered **coating of zinc-iron alloy** and zinc metal.



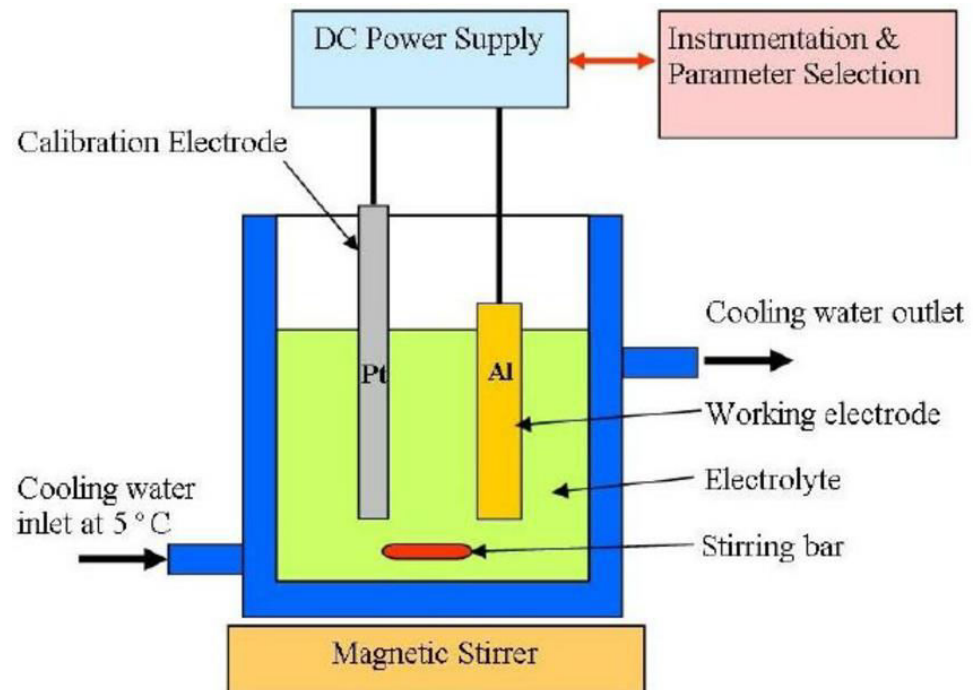
2. Tinning or tinplating





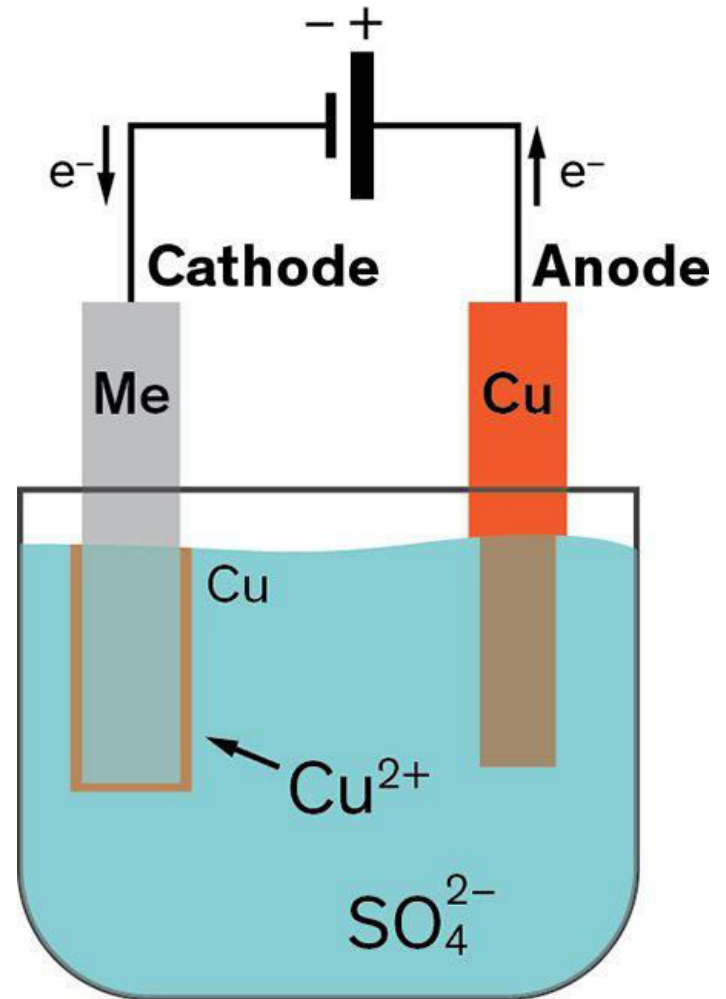
3. Anodization

- Used for metals like Al and Copper.
- A hard layer of metal oxide get coated on metal by electrolysis.
- The metal act as anode hence this process is called as anodization.



4. Electroplating

Silver plated spoon, gold plated ornaments are the example of electroplating.



5. Alloying

- Homogenous mixture of metals or metal and non-metal.

e.g.-

- Bronze is an Alloy of 90% copper and 10% tin.
Stainless steel is an alloy of 74% iron, 18% chromium and 8% carbon.
- Alloy of mercury are called as amalgams.