Durable Industrial Finishing Company

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PLATING: What is it?

- Also called electroplating, plating is the mechanically bonding of one metal to another for the purpose of corrosion protection, decorative appeal, hardness, electrical conductivity, reflectivity, and/or wear resistance
- In a nut shell, plating modifies the surface properties of the base metal to make it more suitable for its intended use

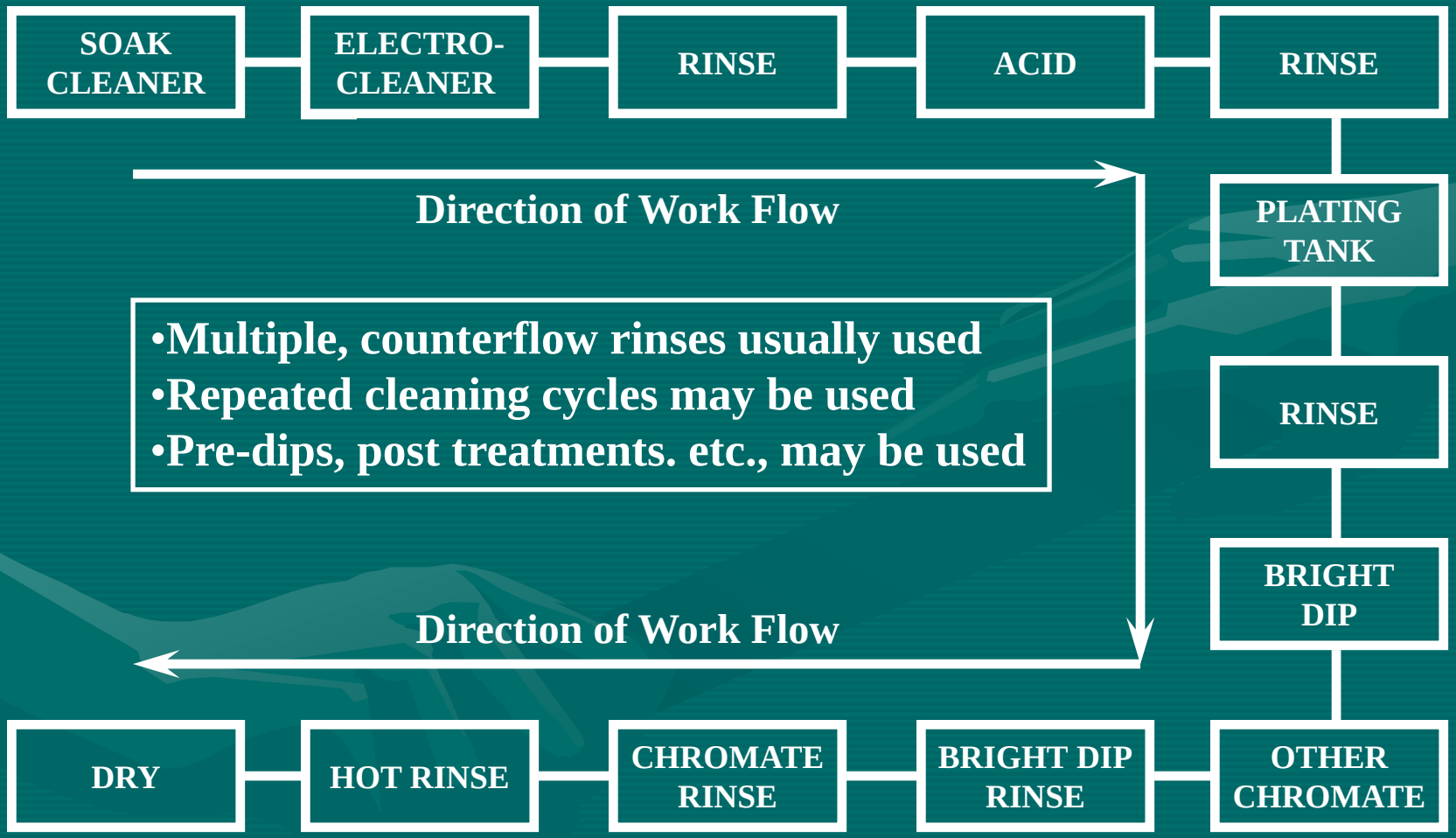
Typical Properties Achieved Through Plating

- Corrosion resistance
- Appearance
- Abrasion resistance
- Value (silver/gold, etc)
- Solderability
- Rubber Bonding
- Electroforming
- Electrical Resistance
- Reflectivity
- Diffusion Barrier
- Lubricity
- High Temp. Resistance

CRITICAL STEPS IN PLATING

- **Racking/Loading (position, number of parts)**
- **Amperage (amount of current for the number of parts)**
- **Cleaning (strength, temperature, time)**
- **Pickling/Acid (strength, temperature, time)**
- **Rinsing (time, flow of water, cleanliness)**
- **Plating process (Zn, Ni, Sn, Ag, Au, etc.)**
- ***Chromates (strength, pH, temperature, time, age of chromate)***
- ***Post-dips (strength, age, temperature, pH)***

Typical Zinc Plating Cycle



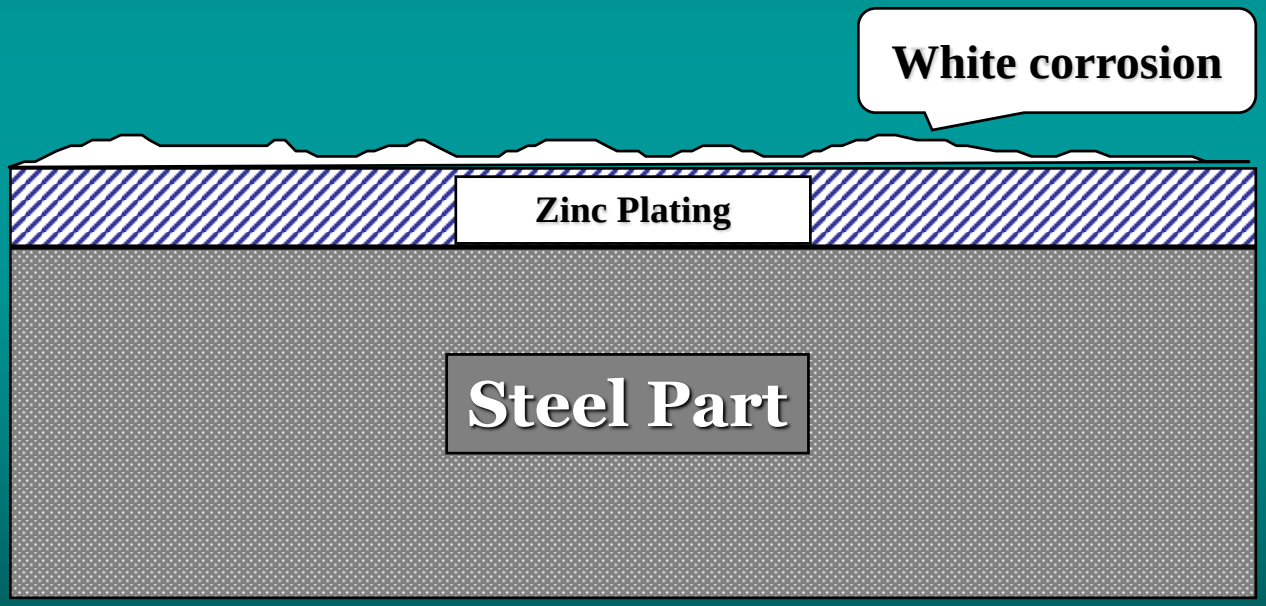
What happens to steel?

- Steel is the cheapest structural material available for countless uses
- However, steel is not very resistant to corrosion (red rust)

Rust damages (pits) the surface of the base metal

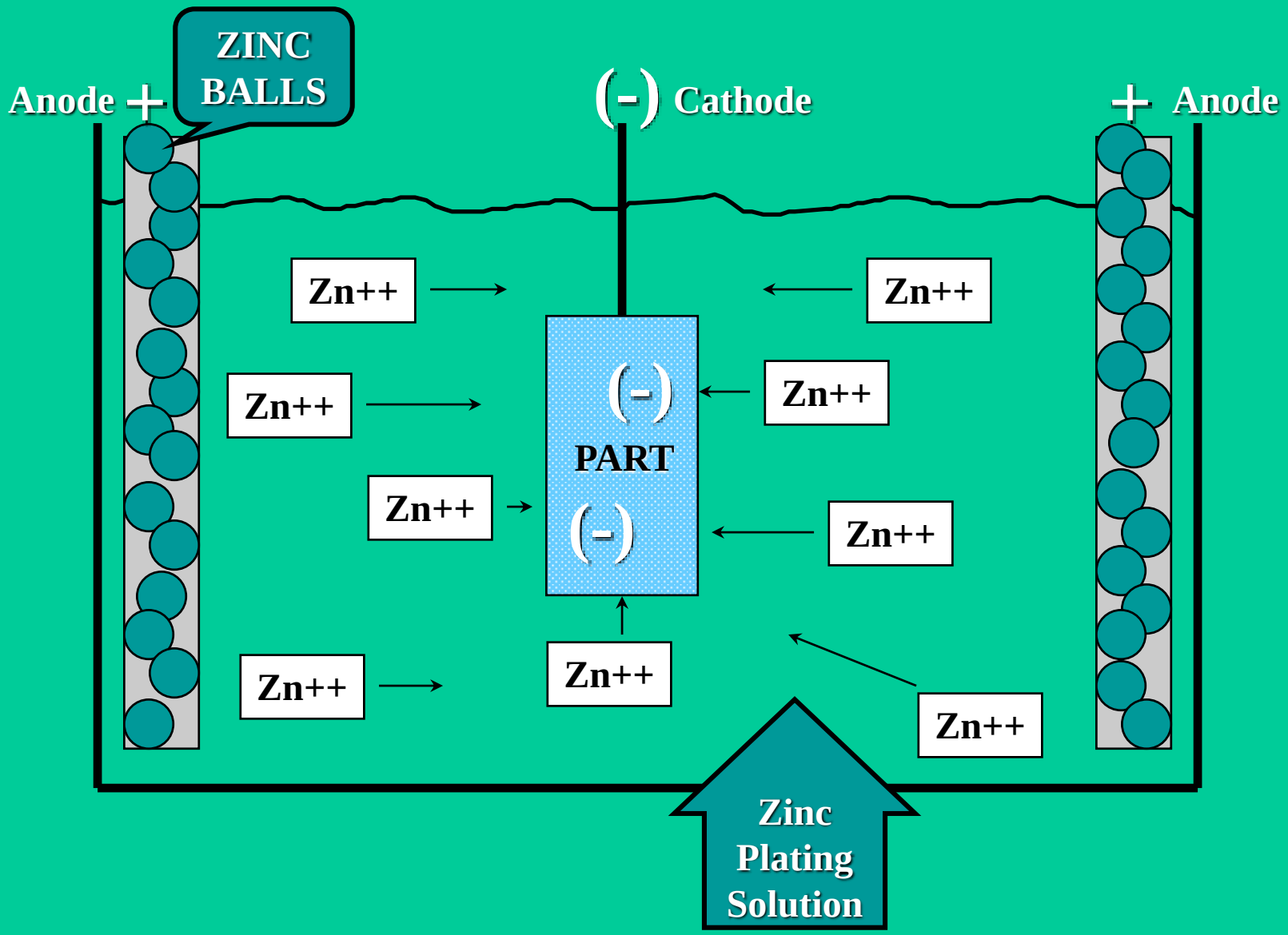
What happens to zinc?

- Zinc metal will corrode (white corrosion) if not protected by a chromate finish
- As the zinc corrodes, it fails to protect the base metal and red rust of the base metal occurs

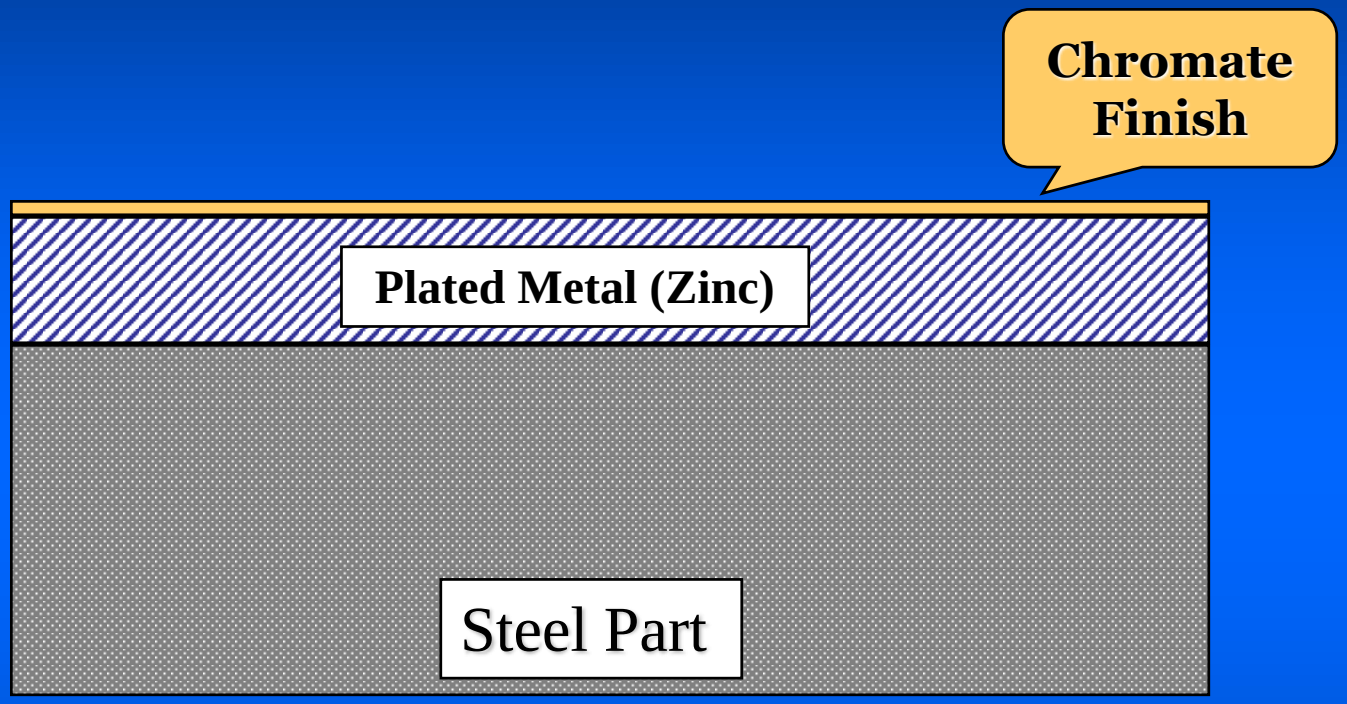


Rust damages (pits) the surface of the base metal

The Plating Tank



ZINC PLATED PART



- The part is protected from corrosion by the zinc plating
- The zinc plating is protected from corrosion by the chromate finish

TYPES OF CHROMATES

- **Hexavalent**
  - Clear
  - Yellow
  - Bronze
  - Black
  - Olive Drab / Green
- **Trivalent**
  - Blue Bright (Clear)
    *Thin Film
  - Non-hex thick film passivates (non-colored, black). Can be dyed.

Hexavalent Chromates

- Excellent corrosion protection properties
- Fairly inexpensive
- Easy / fast to apply @ room temperature
- Variety of colors
- Self-healing properties
- Can not be baked
- Carcinogenic / health issues
- Considered environmentally non-friendly
  (do not meet ELV, RoHS, WEEE requirements)

Why the elimination of hexavalent chromium?

- To meet the requirements of ELV, RoHS and WEEE directives
- Hexavalent chromium is carcinogenic by nature. Hexavalent chromium compounds can slip through cell membranes and react with DNA causing cell mutations/cancer
- Hexavalent chromium is a strong oxidant that poses a threat to biological systems

RoHS

RoHS

- **Restriction of Hazardous Substances** in Electrical and Electronic Equipment (RoHS)
- Directive (2002/95/EC)
- As of July 1, 2006, this directive bans lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyls (PBBs) and polybrominated diphenyl ethers (PBDEs) from all new electrical and electronic equipment sold to EU companies and manufactured in the EU.

Computer Hardware is Subject to RoHS Directive
Automotive Hardware is Subject to ELV Directive

Non-Hexavalent Passivates

Pros:

- **Environmentally and health friendly**
- **Meet ELV, RoHS, WEEE requirements**
- **Can be baked after application**

Non-Hexavalent Passivates

Cons:

- More expensive (contain expensive tri-chromium compounds, organic acids, and other metals)
- Many must be heated to apply (typically 140°F)
- Slower to apply (increases cycle time)
- Not self healing (require additional top coats for protection – more expense)
- Lower corrosion protection than hexavalents (without topcoats/seals)
- Less color variety (non-colored & black)

TYPICAL SALT SPRAY HOURS

- Clear Trivalent 12 – 24 hours
- Clear Hexavalent 20 – 32 hours
- Black Hexavalent 72 hours
- Yellow Hexavalent 96 hours
- Olive Drab / Green 168 hours
- Non-hexavalent thick film 96 hours
- Non-hexavalent yellow/black 120 hours
- *(all results, except for non-hexavalent black, are without seals/topcoats)*

Topcoats / Seals

- There are a variety of topcoats / seals available. Silicated dips, polymers/lacquers, cross-linking polymers, lubricating seals (torque-n-tension compounds)
- Silicated dips offer some self-healing help and increase corrosion protection. These are very thin and will not cause dimensional problems with fasteners

Topcoats / Seals (cont.)

- Polymers / lacquers offer enhanced corrosion protection as well as scratch resistance
- Polymers / lacquers can pose some conductivity issues
- Polymer / lacquer films can be thick and may cause fit/dimensional issues in fasteners, especially in threaded areas
- Lubricating seals (torque-n-tension) offer enhanced corrosion protection, some self-healing help, and lubricity, changing torque values of the surface (automotive fastener requirements). These seals can be expensive to apply.

THANK YOU!

- Terry Windham, Technical Sales
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