



Zn

# Zinc Coatings

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# About my research work

I'm going to tell to present is practicaly based on the research work I'm going at the department of "Innovation materials and corrosion protection". The research in this field is of great value for corrosion protection of steel and iron constructions. I'm particular interested in zinc coatig for corrosion protection.

# Methods of applying zinc coatings.

- ▶ Hot-dip galvanizing method

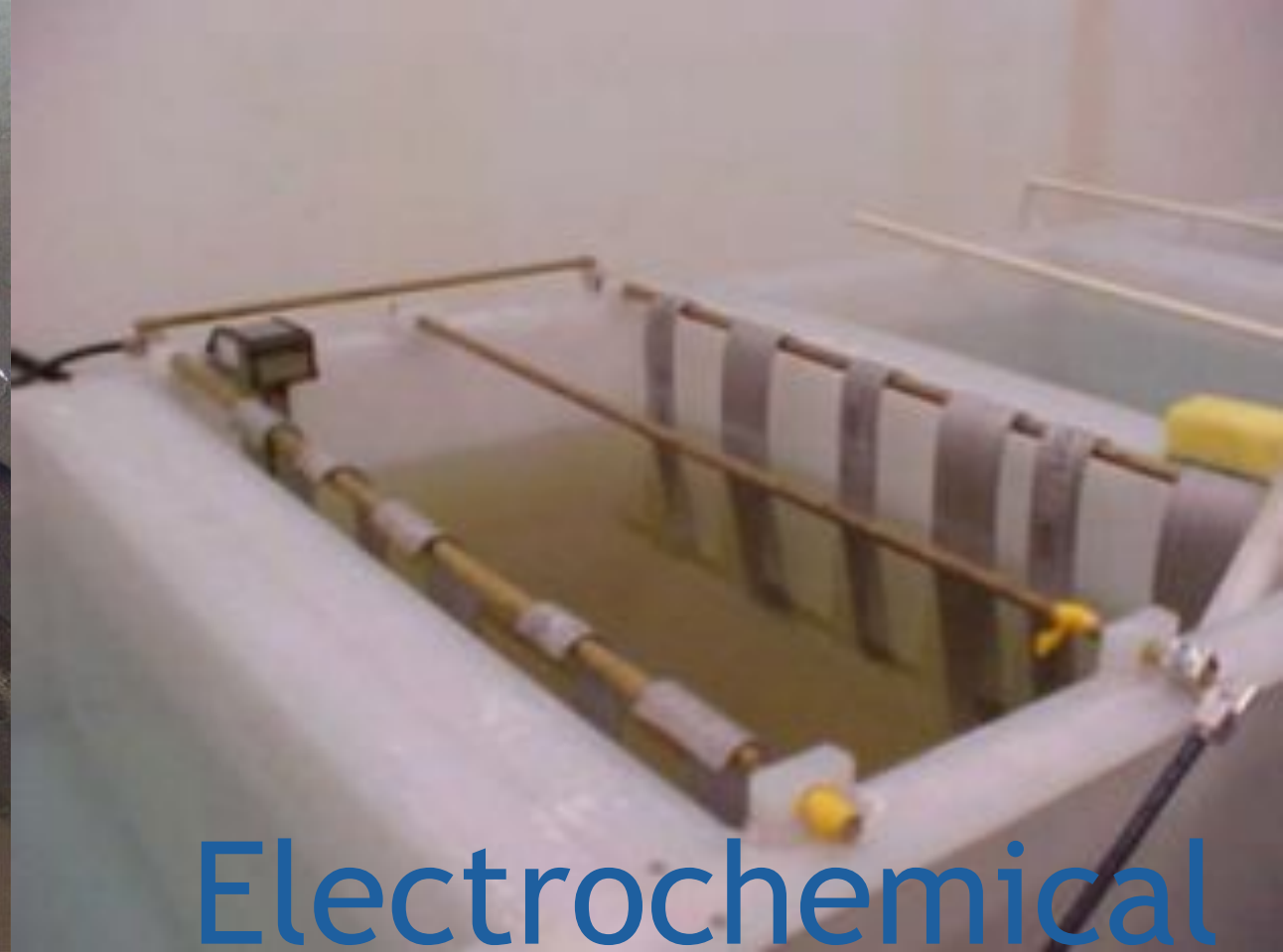
the coating of metal (usually iron or steel) with zinc coating to protect against corrosion by dipping the product in a bath of molten zinc at a temperature of about 460 °C.

- ▶ Electrochemical method

application of zinc on the surface was done under the current from solutions



Hot-dip galvanizing

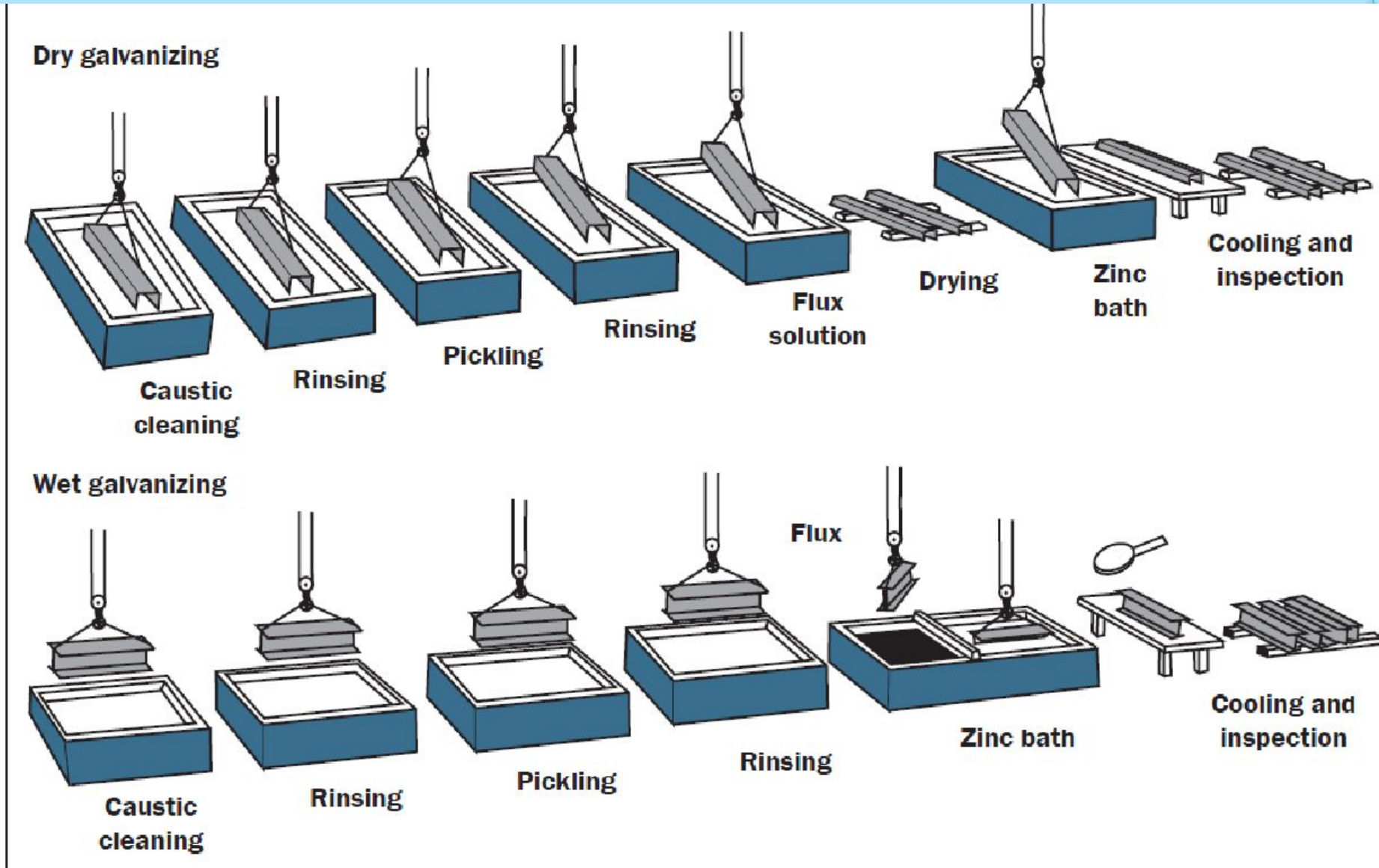


Electrochemical galvanic bath

# Hot-dip galvanizing process

Batch Hot-Dip Galvanizing. The batch hot-dip galvanizing process, also known as general galvanizing, produces a zinc coating on iron and steel products by immersion of the material in a bath of liquid zinc. Before the coating is applied, the steel is cleaned to remove all oils, greases, soils, mill scale, and rust. The cleaning cycle usually consists of a degreasing step, followed by acid pickling to remove scale and rust, and fluxing, which inhibits oxidation of the steel before dipping in the molten zinc.

# Stages of hot-dip galvanizing process



# Stages of hot-dip galvanizing process

- ▶ Caustic cleaning (NaOH - sodium hydroxide)
- ▶ Rinsing in water
- ▶ Pickling
- ▶ Rinsing in water
- ▶ Flux solution (  $\text{NH}_4\text{Cl}$ ,  $\text{ZnCl}_2$ , glycerin)
- ▶ Drying
- ▶ Zinc bath
- ▶ Cooling and inspection





# Electrochemical method

$$E^0_{\text{Zn}^{2+}/\text{Zn}} = -0,76\text{B}; E^0_{\text{Cd}^{2+}/\text{Cd}} = -0,402\text{B}; E^0_{\text{Fe}^{2+}/\text{Fe}} = -0,44\text{B}$$

- ▶ I'm going to tell you about electrochemical method of zinc coating. Well known two groups of electrolytes for electrochemical zinc coating.
- ▶ Zinc is anodic protector to steel or iron surface, because it has small compared to steel electrochemical potential. Zinc has good protection properties for steel constructions in soft atmospheric environment.

# Types of electrolyts.

- ▶ Acid electrolytes
- ▶ Alkaline electrolytes



# Ingredients of electrolytes

## ▶ Acid electrolyte

**ZnSO<sub>4</sub> 140-160 g/l**  
**NH<sub>4</sub>Cl (NaCl) 1-3 g/l**  
**(NH<sub>4</sub>)<sub>2</sub>SO<sub>4</sub> 10-12 g/l**  
**H<sub>3</sub>BO<sub>3</sub> 15-25 g/l**  
**brightening agent additives**  
**pH 4,5÷5,5**

**ZnSO<sub>4</sub> 80-120 g/l**  
**NH<sub>4</sub>Cl (NaCl) 180-220 g/l**  
**H<sub>3</sub>BO<sub>3</sub> 15-25 g/l**  
**brightening agent additives**  
**pH 4,5÷5,5**

## ▶ Alkaline electrolyte

- ▶ ZnO 40-80 g/l
- ▶ NaCN 80-90 g/l
- ▶ NaOH 40-50 g/l
- ▶ Brightening agent additives
- ▶ pH 10-11

# Properties of electrolytes

- ▶ Acid electrolytes
- ▶ Simple in composition and in the preparation, high allowable current density and the current output,
- ▶ coatings with high gloss, low nastorajivaet steel base
- ▶ high concentration of chloride ions is highly corrosive electrolyte
- ▶ Alkaline electrolytes
- ▶ Very toxic electrolytes
- ▶ A serious disadvantage of cyanide electrolytes galvanizing (without additives)
- ▶ is significant hydrogenation of steel parts, which leads to a sharp deterioration
- ▶ mechanical properties of parts after coating: reduces the ductility, increased fragility

# Conclusions.

- ▶ I think, some special literature and articles about zinc coatings in steel surfaces and constructions are very interesting and have a great value for specialists from galvanic plants, professors from our university and students from departments of electrochemical industry and corrosion protection.



thanks for attention!