ANODIZING

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- What is Anodizing
- The purpose of Anodizing
- Reaction in Anodizing Process
- Characteristic of Anodizing
- Anodizing Benefit
- Anodizing Method
- Type of Anodizing
- Anodizing Process
- Application

What is Anodizing ?

- Anodizing is the successful development and control of a natural oxidation process that occurs when aluminum is exposed to the atmosphere

Try to corrode the aluminum but in control way

Reaction in Anodizing Process

- **Anode Reaction**
  - **Reaction at Metal/Oxide**

$$2Al + 3O_2^- \longrightarrow Al_2O_3 + 6e^-$$

  - **Reaction at Oxide/Electrolyte**

$$2\ Al_{\ (metal)} + 3H_2O \longrightarrow Al_2O_{3\ (oxide\ coating)} + 6H^+ + 6e^-$$

  - **Total reaction in anode**

$$2Al \longrightarrow 2Al^{3+} + 6e^-$$

- **Cathode Reaction**

$$6H^+ + 6e^- \longrightarrow 3H_{2\ (gas)}$$

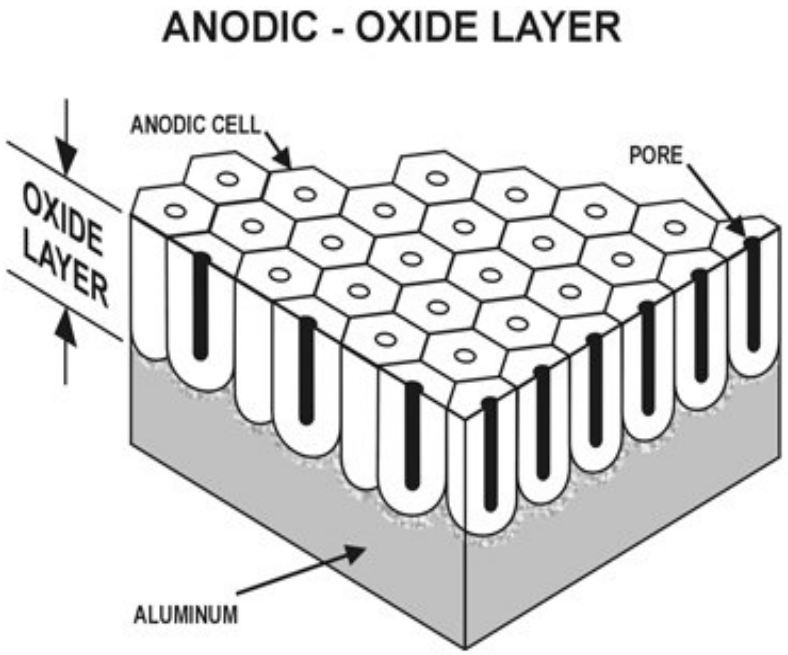
Reaction *(cont'd)*

- Total Reaction in anodizing process

$$2Al_{(metal)} + 3H_2O \rightarrow Al_2O_3 + 3H_2$$

The purpose of Anodizing

- The purpose of anodizing is to form a layer of aluminum oxide that will protect the aluminum beneath it



Characteristic of Anodizing

- Hard, comparable to sapphire
- Transparent, similar to glass
- Insulative and static resistant
- Wide variety of colors and finishes
- Integral with aluminum surfaces, non-flaking

Anodizing Benefit

- Durability
- Color stability
- Ease to maintenance
- Aesthetics
- Cost
- Health and Safety

Anodizing can improves the properties of aluminum :

- **Corrosion resistance**

  A low porosity of oxide film will have good resistance against pitting, galvanic and general corrosion

- **Wear Resistance**
- **Surface Hardness**

  Bright/Architectural Anodizing increases the surface hardness from 60-130 HV to value between 200-350 HV

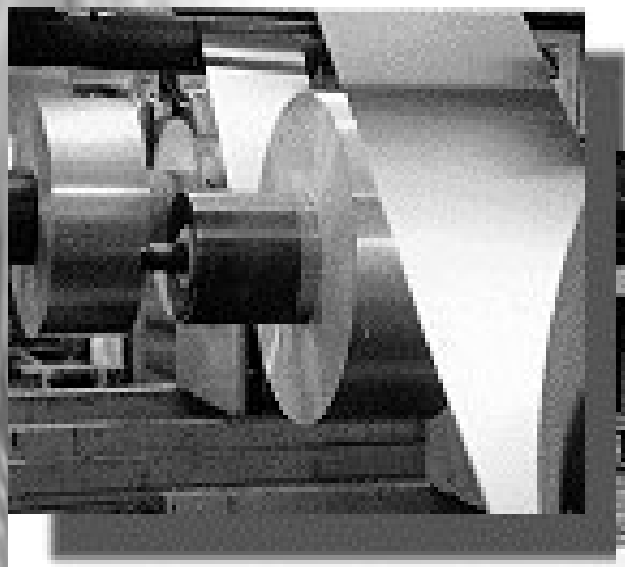
- **Electrical Resistance**
- **Fire Protection**

  Anodic oxide layers give a minor increase in the fire protection of aluminum constructions. The melting point of the oxide surface increases from approximately 650°C to approximately 2000°C.

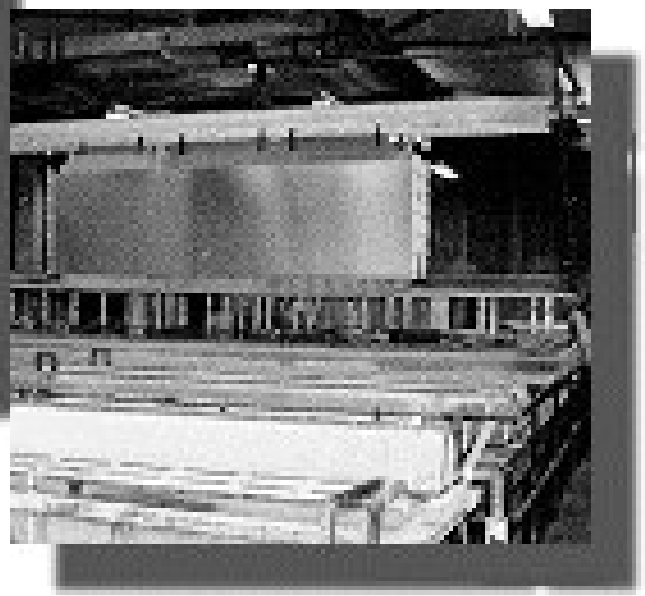
Anodizing Method

Continuous Coil Anodizing	Sheet Anodizing	Batch or Piece Anodizing
Uses High volume Coiled sheet Foil Products with less severe forming.	**Uses** Wide widths Plate Large fabricated products.	**Uses** Extrusions Castings Parts with severe forming
Advantages Wide range of metal and film thicknesses Less material handling Precise color control and uniformity Cost effective	**Advantages** Small runs Thicker films Anodized edges	**Advantages** Small runs Thicker films Anodized edges
Disadvantage Bare edges on stamped parts Crazing when severely formed Limited to sheet and foil	**Disadvantages** Color variance High costs Film thickness variance Crazing when severely formed	**Disadvantages** Color variance Excessive handling High costs
*Coil anodizing involves continuous unwinding of coils through a series of anodizing tanks and then rewinding.	*Sheet anodizing involves racking or framing of sheets and immersing them in large tanks.	*Piece anodizing involves racking parts and immersing them in a series of treatment tanks

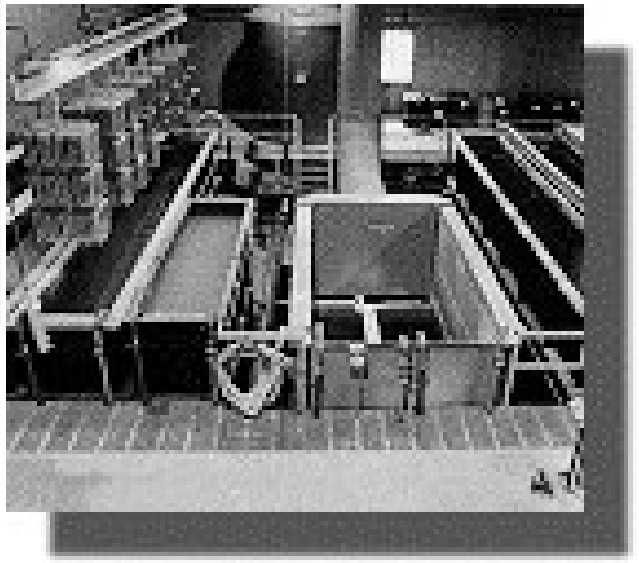
Anodizing method *(cont'd)*



Continuous Coil Anodizing



Sheet Anodizing



Batch or Piece Anodizing

Type of Anodizing

- Bright Anodizing
- Hard Anodizing

BRIGHT ANODIZING

- Bright anodizing is a special type of anodizing (in combination with polishing) when glossy or shiny surfaces are required
- To achieve both good abrasion resistance and good reflectivity an oxide coating thickness of approximately 10 μm is suitable
- Application : Finishing trim components, automotive applications like window trims and bumpers

HARD ANODIZING

- Hard anodizing is a term used to describe the production of anodic coatings with film hardness or abrasion resistance as their primary characteristic
- The hardness can achieved greater than 350 HV. Hardness values up to 1400 HV are reported to be obtained from a mixed electrolyte

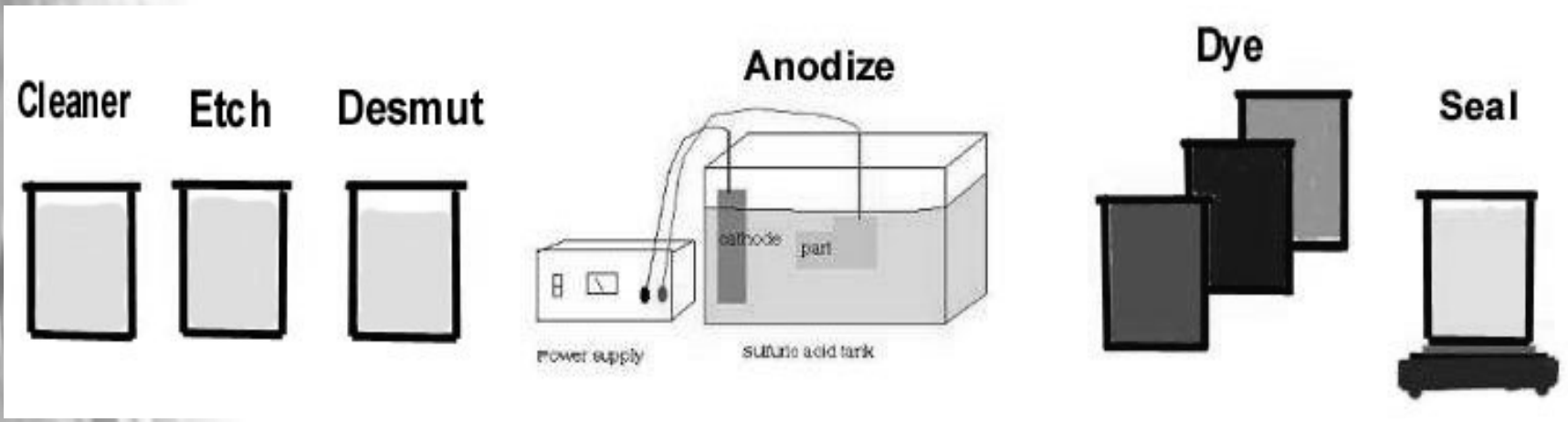
Hard Anodizing *(cont'd)*

- Hard anodized aluminum shows a ***good heat resistance***, and a hard anodic oxide coating of 75 μm withstands short exposures to temperatures of the order of 2000^0C
- The coatings give also very good ***electrical insulation*.**
- Application: In industry for components which require a very wear resistant surface such as pistons, cylinders, and hydraulic gear. Another application is in the coating for the production of flame and chemically resistant surfaces.

Hard anodizing - black finish

Hard black anodizing on casting

Anodizing Process



- **Cleaning**

The Purposes:

- ✓ Removal of unwanted surface contamination.
- ✓ Prepare the surface for further processing.

- **Pretreatment**
  - **Rinsing** :
    - ❖ Effectively terminate the previous reaction progress
    - ❖To remove all by-products and contaminants of the preceding stage
    - ❖Prevent cross contamination from one process with another
  - **Etching**

Etching is design to dissolve the surface aluminum so that we can achieve the following :

- ❖Diminish extrusion die lines and mild scratch
- ❖Develop a smooth, uniform finish
- ❖Obtain a matte (diffuse) finish

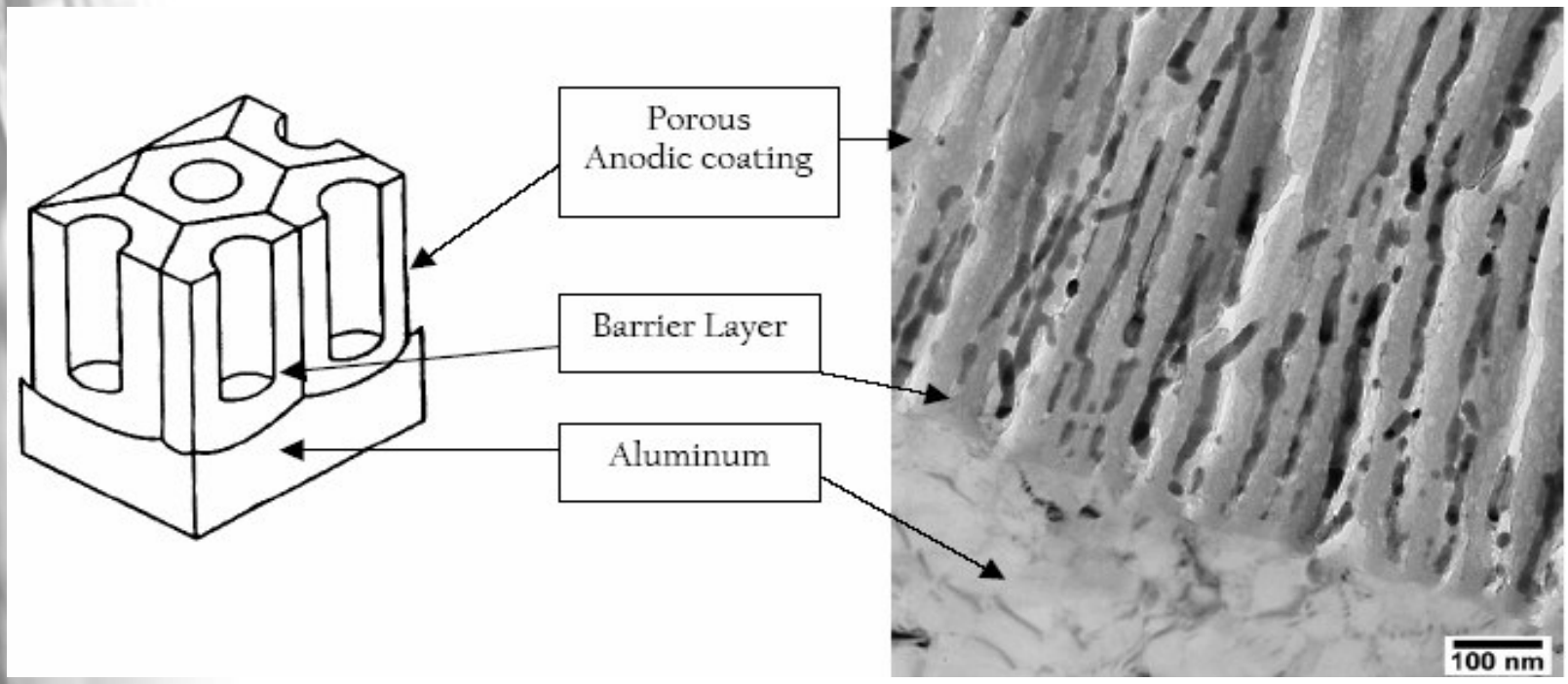
Pretreatment *(cont'd)*

– Deoxidizing & Desmutting

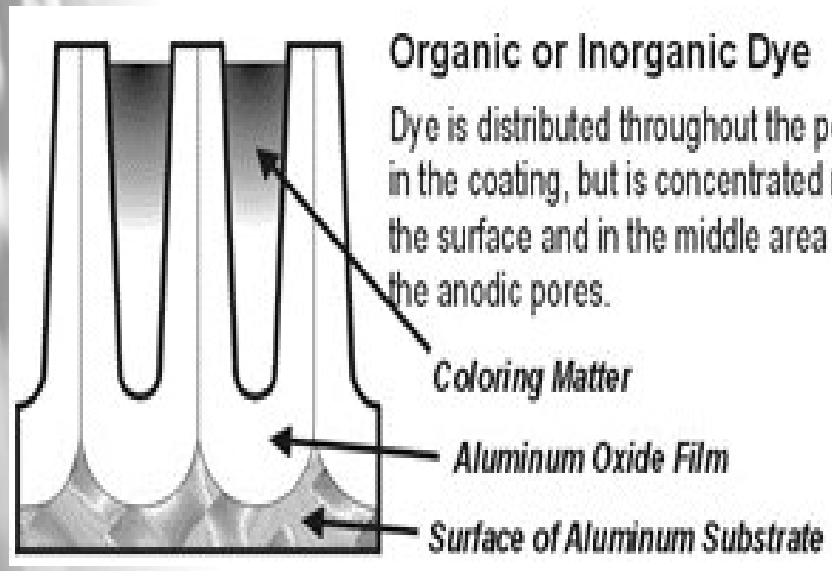
Prepares the surface for subsequent finishing:

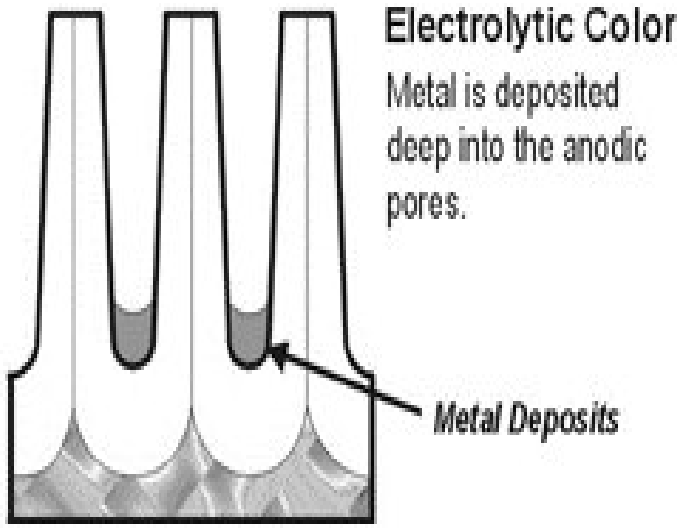
- Remove surface oxide
- Remove "smut"-which is combination of intermetallics, metal and metal oxide on the surface after cleaning/etching
- Activate surface

- **Anodizing Aluminum**
  - ❖ Anodizing is the electrochemical oxidation of an aluminum surface to produce a stable film oxide
  - ❖ In this process a porous, insulative layer composed of aluminum and oxygen is produced by passing electricity through the aluminum in a conductive medium

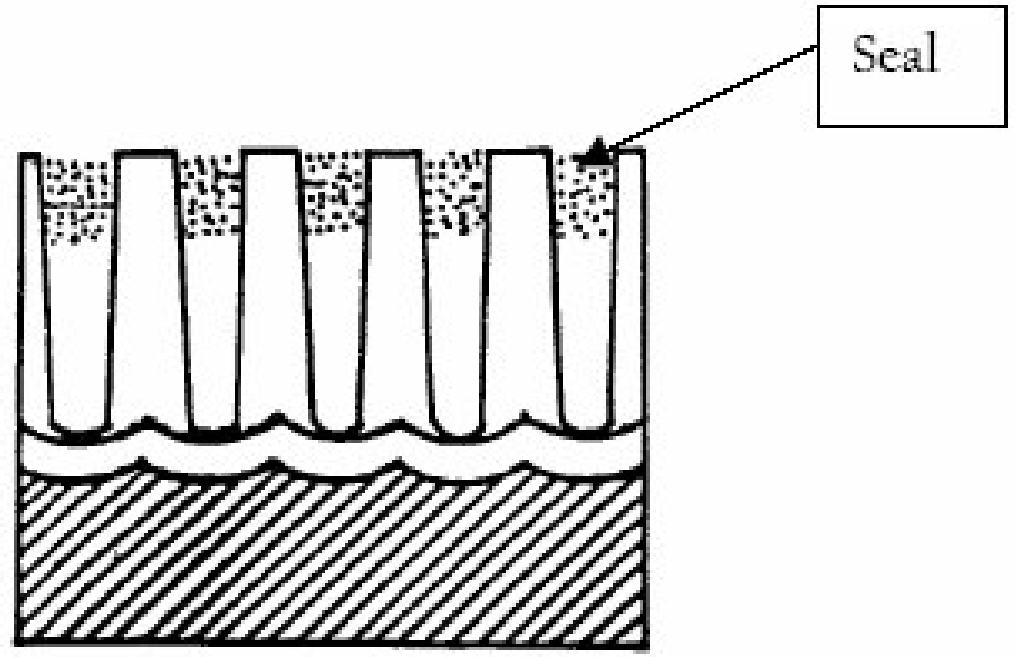


- **Coloring**
  - ❖This process is to enhance the appearance of the material and widen the application for anodized aluminum
  - ❖Current power used to deposit metal (Cu, Ni, Co etc) at the bottom of the pore.





- **Sealing Anodic Coatings**
  - ❖The purpose of sealing an anodic coating is to close the pore structure of the anodic film and render the film inert
  - ❖The sealing process renders the film :
    - ✓Non-staining
    - ✓Non-absorbing
    - ✓Non-reacting
    - ✓Non-corroding



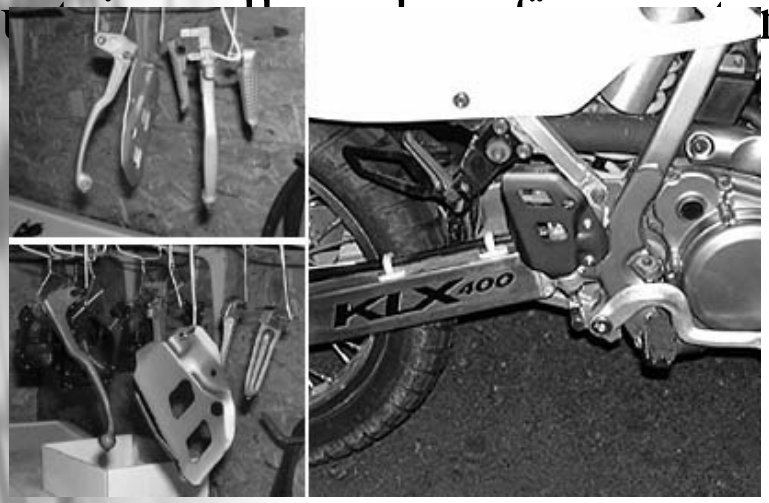

CHAR
125/225A
STARTE
BATTER
RED DEVIL
LUBE
BRAIN OPENER


125/2
STA
BAT


STARTER CHA
BATTERY TEST
RED DEVIL
LUBE
BRAIN OPENER

Anodized Aluminum Applications

- Structures and architectural categories of all types
- Commercial and residential building products
- Food preparation equipment
- Furniture
- Sporting goods and boats
- Motor vehicle components
- Building exteriors, such as storefronts, c ms.



Thank You…..!