EDU[**CAD**]TION **STUDY GUIDE**

How to Plan Your Design for Anodized Finishes

Chapter 5, Lesson 15

SendCutSend

What Are Non-Coated Finishes?

- Non-coated finishes change the surface of the material instead of adding a separate layer.

- They improve performance, appearance, and corrosion resistance by modifying the material itself.

- Anodizing, passivation, and black oxide are the most common examples.

What is Anodizing?

• Anodizing is an electrochemical process that forms an oxidation layer on aluminum surfaces.

• This layer provides corrosion resistance, increased durability, and can be dyed for cosmetic purposes. It's one of the most common non-coated finishes used in manufacturing for both functional and aesthetic reasons.

Benefits:

- **Corrosion Resistance**: The oxidation layer protects aluminum from environmental exposure.
- **Durability**: Adds a hard, wear-resistant shell to the surface.
- **Cosmetics**: Dyes can be added for color finishes (e.g., red, blue, gold).
- **Electrical Insulation**: The anodized layer is non-conductive, making it ideal for electrical enclosures.

Note: *Colors available at SendCutSend (see Figure 1.1).*

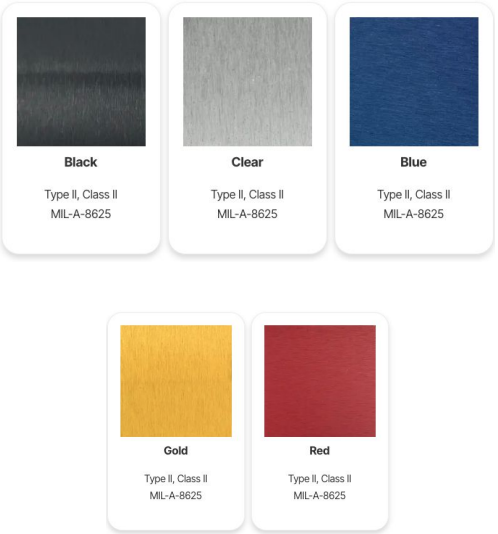

Figure 1.1

Design Considerations for Anodizing

• While anodizing doesn't add significant thickness, it does slightly change the dimensions of a part due to the oxidation layer.

• Expect around 0.0005" to 0.001"of surface growth (about a quarter of a human hair).

• For standard sheet metal, this is negligible, but for tight-tolerance CNC assemblies or press fits, it can matter.

Design tip: Perform press fits or precision machining *after* anodizing to ensure accuracy.

Resources:
Anodizing Guidelines: https://sendcutsend.com/guidelines/anodizing/

Different Types of Anodizing

There are multiple types of anodizing with varying hardness and thickness:

- **Type II (Decorative Anodizing)**: Standard cosmetic finish; available in multiple colors.

- **Type III (Hard Anodizing)**: Thicker, more durable, and offers greater wear resistance. Color is added during the chemical bath using dyes, similar to dyeing Easter eggs, the color embeds into the oxidation layer.

Other Non-Coated Finishing Processes

Non-coated finishing is not limited to aluminum anodizing:

- **Titanium Anodizing**: Achieves color through electrical current and light refraction.
- **Stainless Steel Passivation**: Removes impurities and forms a new oxide layer for added protection.
- **Carbon Steel Black Oxide:** Creates a darkened surface layer that enhances corrosion resistance.

Summary

Non-coated finishes like anodizing provide protection, durability, and aesthetics without the drawbacks of additive coatings. They are especially effective for aluminum parts that need lightweight, corrosion-resistant finishes. Remember to design with post-anodizing assembly and hardware installation in mind. In the next lesson, you'll begin combining these concepts into a capstone project that ties together all the principles from previous chapters.

Learn more at https://sendcutsend.com/education/