

FACT SHEET

ANODIZING™

PROTECTION | BEAUTY | DURABILITY | CONFIDENCE ... FROM WITHIN™

HARDCOAT ANODIZING

*For durable protection of aluminum components...
Hardcoat is the easy solution!*

ABOUT HARDCOAT ANODIZING

Hardcoat anodizing (*Type III*) is an electrochemical process that yields an anodic oxide integral to the aluminum part. Hardcoat anodizing offers a variety of beneficial coating properties:

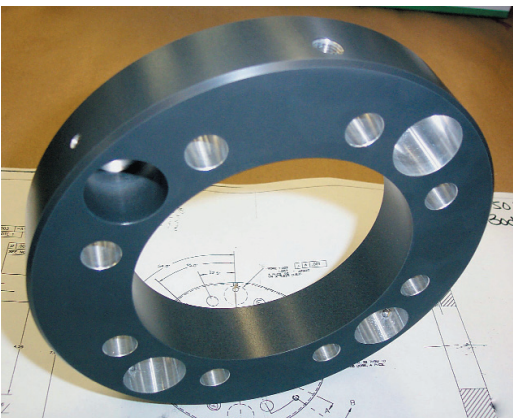
- Thickness
- Corrosion Resistance
- Hardness and Wear Resistance
- Electrical Resistance
- Temperature Resistance
- Low Friction Coefficient after Lubrication
- Reduced Risk of Thermal/Physical Distortion.

The specific properties of the anodic oxide will be dependent upon the specific alloy being treated and the process parameters being applied.

The oxide itself is integral to the aluminum component or part. Hardcoat *penetrates* the base metal as much as it builds up on the surface; the term *thickness* includes both the buildup and the penetration.



For this 6xxx alloy marine application, hardcoat anodizing was followed by post treatment (sealing).



This machined part exhibits high tolerances. The diameter of an unmasked opening will decrease by an amount equal to the coating thickness.

Color will vary according to alloy and treatment parameters, as well. Alloys that are well-suited to machining may not be well-suited to hardcoat anodizing.

OXIDE THICKNESS AND SPECIFICATION GUIDELINES

Typical industry practices yield hardcoat anodizing in thicknesses ranging from approximately 0.5 mils (about 12.7 microns) up to 3 mils (about 76.2 microns)*, depending on the alloy and the application. Special processes may yield thicknesses up to 9 mils (about 228.6 microns). Like coatings, hardcoat anodizing changes the dimensions of the basic part. Unlike plating, only half of the hardcoat is buildup (the other half is penetration into the aluminum substrate).

**One mil equals 25.4 microns or about one one-thousandth of an inch.*

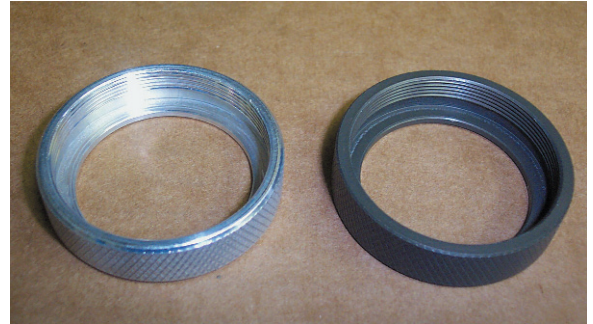
The anodic oxide builds up at different rates on each alloy. To enable the anodizer to have accurate control, it is important to specify the alloy. Some alloys require different procedures than others. If the alloy is not properly designated, failures can occur.

HARDCOAT ANODIZING

ALLOYS

When developing a hardcoat-anodizing specification, it is important to consult with your anodizer to ensure receipt of a satisfactory product. Consider the following:

- The application of the component
- Environment of use
- Aluminum alloy and temper
- Corrosion and hardness requirements
- Thickness range of the oxide
- Final dimensional tolerances
- Corner and edge radii
- Optimum location for contact points (i.e., racking)
- Approval requirements and/or other standards.



The part on the left is unfinished; the part on the right has been hardcoat anodized.



These 2xxx alloy rings were hardcoat anodized for an aerospace application; the red is masking.



These pistons were hardcoat anodized to minimize the microwelding effect that can occur in the ring groove when pistons reach high temperatures.

END-USE APPLICATIONS

Hardcoat anodizing is ideally suited for many product applications. The natural colors range from light tan to gray/brown and black, from gold to bronze, and many shades of gray. Various techniques can be employed to enhance the corrosion resistance or abrasion resistance of the treated surface.

Here are just a few examples of hardcoat anodizing applications:

- | | | |
|--------------|--------------|-------------|
| • Aerospace | • Marine | • Hydraulic |
| • Defense | • Medical | • Chemical |
| • Energy | • Electronic | • Textile |
| • Automotive | • Pneumatic | • Bakeware. |

Hardcoat anodizing resists abrading and other environmental degradation, making it the ideal solution for pistons, cylinders, cams, gears, splines, swivel joints, and hydraulic/pneumatic components.



This hardcoat-anodized air compressor scroll is produced in 6061-T6 alloy and temper.

The Aluminum Anodizers Council is the international trade association of firms engaged in aluminum anodizing. The Council serves as a technical resource for members and customers by disseminating information through publications, educational events, and Web-based programming.

*Many Council members engage in hardcoat anodizing.
For more information, contact AAC or:*