Elite metal finishing, llc

Hardcoat Anodizing

EliteMetalFinishing.com

In an effort to promote better understanding of the Process of Aluminum Hard coating, we offer the following facts and suggestions:

1. Hardcoat IS different; Hardcoat is NOT plating.
2. Hardcoat PENETRATES the base metal as much as it builds up on the surface and the term THICKNESS includes both the buildup and the penetration.
3. Hardcoating a shaft .002 thick will increase the diameter by only .002. Plating the same shaft .002 thick would increase the diameter .004, since plating is 100% surface build up.
4. Be positive before you machine your parts that you are allowing for the hardcoat buildup and not a plating buildup.
5. When you call for hardcoat, the use of the term "Build up per surface" will make it impossible to misunderstand what you are requesting.
6. Exacting dimensions can be maintained with the Hardcoat Process. Standard commercial tolerance is + .0005 on a coating thickness of .002. For closer tolerance requirements, consult the finisher in advance.
7. Allowing a tolerance on coating buildup means that you must machine closer than blueprint dimensions. For example: A shaft diameter which is to finish at 1.500 + .001 and is to be hard coated .002 thick(.001+ .0001build upper surface), your planning should call out Machine to 1.498 + .0008", your part will then be to finish dimensions after hardcoating.
8. When a "V" thread is to be cut to allow for hardcoating, the formula is "Build up per surface", multiplied by "Four"; this will equal the pitch diameter change. A typical example is: Desired P.D. = .405/.4091 (7/16 N.F. Internal Thread) Coating Thickness .002 + .0002 (.001 + .0001 build up per surface). Minimum build up per surface is.0009x4=.004 P.D. change. Machine P.D. to .4094/.4127.

HOW TO ORDER THE HARDCOAT PROCESS

To save time, trouble, and possible errors, information on the following four items must be known:

1. Alloy
2. Coat Thickness
3. Masking Requirements (if any)
4. Racking Instructions (if possible)

1. **ALLOY** - Hardcoat can be applied to virtually any aluminum alloy. However, since the coating builds up at different rates on each alloy in order to control coatings accurately, it is important to specify the alloy. Also, some alloys require different procedures from others. If the alloy is not properly designated, there is a possibility of damage.
2. **COATING THICKNESS** - Hardcoat may be provided in thicknesses ranging from a few .0001's to .008" or .009", depending on the alloy and the application. Like other coatings, Hardcoat changes the dimensions of the basic part. One half of the Hardcoat build-up and one half is penetration, i.e., .002" hardcoat consists of .001" penetration and .001" added to the original dimension. Therefore, in machining the part, it is essential to allow for the change and to request a specific coating thickness on blueprints and/or purchase orders.
3. **MASKING** - It may be necessary to exclude (or mask) the coating from certain areas of a part. If so, areas to be masked (threaded hole, bored holes, ground points, etc.) should be clearly specified.

   In designing for hardcoat, remember that masking is a hand operation which often, but not always means added total cost. For instance, even if Hardcoat is only required on one area of a part, it is usually much less expensive to permit the part to be coated all over if at all possible. On the other hand, it is usually less expensive to tap holes to a standard size and mask them rather than use oversize taps.
4. **RACKING** - Firm electrical and mechanical "contact" must be made with every part to be Hardcoated. That is, each part must be "racked". Proper racking is a key to economical and effective processing of parts. Since each rack contact point leaves a small void in the coating, it is essential that such contacts be made in non-critical area. Any guidance which can be provided as to where best to rack the part will aid in proper processing.

Before designing a part for Hardcoat, if you have any questions as to how to handle your specific part, please give us a call. We will be glad to advise by telephone or make a personal visit.

ALUMINUM ALLOYS MOST OFTEN USED WITH THE HARDCOAT PROCESS

Hardcoat is recommended for use with virtually all aluminum alloys. This information describes the more commonly used alloys.

IMPORTANT: Be sure to remember that the coating thicknesses mentioned. Below are 50% buildup and 50% penetration. In other words, a .002" coating will buildup only .001" per side and not .002" as in plating and similar coatings. While coatings may vary from a few "tenths" to .008" depending on engineering requirements, the standard coating is .002".

WROUGHT ALLOYS

1100 Series – Most common: 1100 only. Bronze gray in color at .002"; alloy is soft and not particularly good for machining. Maximum practical coating thickness 0025"; .003" possible.

2000 Series – Most common: 2014, 2017, 2024, 2618 (forgings). Avoid sharp corners, particularly on 2011-2017; gray-black at .002" to blue-gray at .004"- .005". Excellent machining characteristics. Maximum practical coating .004"; .006" possible for salvage though not as hard as less heavy coats.

3000 Series–Most common:3003. Gray-black in color at .002". Good for dye work and machining. Maximum coating .002".

4000 Series – Not commonly used.

5000 Series – Most common: 5005, 5052; 5005 best for dyework; 5052 not good for dyework, except black. Both have good machining characteristics. Maximum practical coating .004". 5052 has excellent dielectric when coated to .004".

6000 Series – Most common: 6061, 6063. Almost black at .002", 6061 forms excellent hardcoat for grinding, lapping, honing. Excellent dimensional stability, though a little "stringy" to machine. 6063 used for extrusion. Maximum practical coating .0025". Maximum .003".

7000 Series – Most Common: 7075. Blue-gray at .002". High strength alloy. Not good for grinding and laping; tends to be"checky". Maximum practical coating.004"; maximum for salvage .008".

8000 Series – Not commonly used.

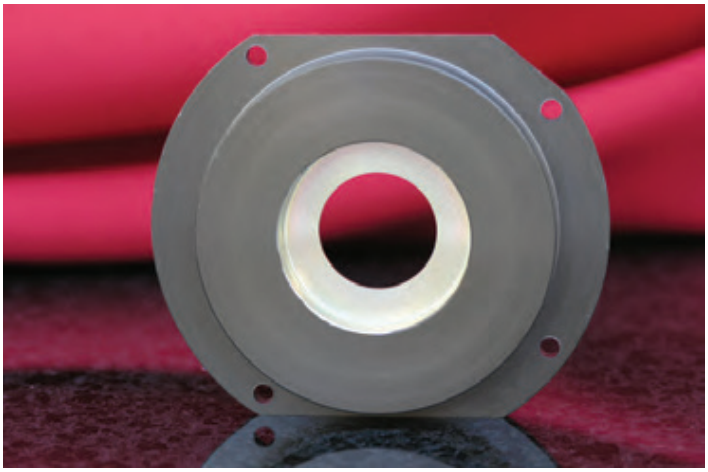
INGOT

Sandcast Alloys – Most common: 319, 355, 356 (also 40E, Ternalloy, Tenzalloy and variety of proprietary alloys). 356T6 is used most often. Grinds and polishes very well. Porosity can cause apparent pits its in coating. Hardcoat will not fill in pores. Maximum practical coating.0044". Salvage .006"

Most common: 218, 360, 380. Only 218 produces hardcoat comparable to that on wrought or sandcast. 218 is difficult to die cast. Maximum .0025". 360, 380 maximum about.001". Color is black, but is not as wear resistant as 218.

Reason for difference in coating quality in die castings is that 218 is 9.4% alloying elements of which the principal one is magnesium. Magnesium is not detrimental to hardcoat and, in fact, these are some high magnesium proprietary sandcasting alloys (such as Almag 35) which hardcoat very rapidly and well. 360 and 380, however, are11.60% and 13.80% alloying elements respectively, and the principal elements are silicon and copper. Both, but principally silicon, are detrimental to a good hardcoat.

NOTE: Hardcoat may be ground, honed, or lapped, but it is much too hard for conventional machining.



RECOMMENDATIONS FOR GRINDING AND FINISHING HARDCOAT ALUMINUM

I. GENERAL

There are many abrasive wheels and compounds suitable for finishing Hardcoat to achieve critical dimensional tolerances or very fine finishes. The recommendations below will more than meet most requirements.

II. GRINDING

A. Surface Grinding- Norton Crystolon (silicon carbide) abrasive (or equal) is most satisfactory. Grit sizes of 80 to 120 will give surface finishes of 8 to 2 micro-inch. Soft wheels in H, I & J grades are preferable for fast stock removal and there is less danger of burning or cracking the work. Typical wheel numbers are 39C60-J8VK for finishes of 6 to 10 and 39C120-H8VK for finishes of 2 to 3 micro-inches.

B. Cylindrical Grinding- Best done with a specification of 39C120-J8VK. This finer grit wheel will be free cutting and yet capable of producing very fine finishes.

C. Internal Grinding- A fine grit wheel such as (Norton) 39C100-J8VK produces best results

D. Coolants- In general, grinding should be done wet using a water coolant and a good medium priced soluble oil mixed approximately 100 to 1. In one instance, Cincinnati "Cimplus" mixed 200 to 1 has been highly successful.

III. Polishing or Lapping

A. Recommended Abrasives- Norbide (boron carbide) abrasive grain (or equal) mixed with a carrier of heavy oil or petroleum jelly will give fastest and best results. Use with polishing sticks or brushes is recommended. Grit size range should be 400 to1200, depending on the finish requires.