The Effect of Alloy Selection to Anodizing

In order to obtain reproducible anodizing finish results from batch to batch, many variables must be kept under close control. One of these variables to be considered is the selection of the aluminum alloy.

Commercially-pure aluminum is used for some applications; more often, however, aluminum is mixed (alloyed) with other metal such as copper, manganese, silicon, magnesium, and zinc, in various proportions. Product performance is determined in part by alloy composition and in part by production method, in turn, is strongly influenced by the temper given to the alloy through various types of mechanical and thermal treatment. Structural and certain physical properties can also be influenced significantly by the choice of alloy and temper.

As aluminum offers a wide range of mechanical properties through the appropriate selection of alloy and temper, it is important to recognize that the type of alloy has a pronounced effect on shade. The brightest and clearest anodic films are produced using the purest form of aluminum; on the other hand, anodic films become duller as the proportion of alloying constituents increases.

Aluminum extrusions, for the most part, are produced from 6000 series alloys with magnesium and silicon representing their major alloying elements. Magnesium has a characteristic to produce a heavier and duller shade while silicon imparts a gray color to the anodic film.

Silicon and Magnesium Composition Limits of Wrought Aluminum Alloys

Percentage of composition by mass

Alloy	Silicon	Magnesium
6005	0.60 – 0.90	0.40 – 0.60
6061	0.40 – 0.80	0.80 – 1.20
6063	0.20 – 0.60	0.45 – 0.90
6105	0.60 – 1.0	0.45 – 0.80
6463	0.20 – 0.60	0.45 – 0.90

Note: Compositions correspond to those of the Aluminum Association

Conclusion

Since various alloys produce different shades when anodized identically, the designer of an assembled part should use the same alloy throughout if the shades of the individual components are to match.

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Sources:

1) Coloring Anodized Aluminum – Frank P. Stiller
2) The Aluminum Extrusion Manual - The Aluminum Association / Aluminum Extruders Council
3) Aluminum Standards and Data – The Aluminum Association